OFFICE OF NAVAL RESEARCH

Final Report

# A SUMMARY OF NAVY AIR COMBAT ESCAPE AND SURVIVAL

February 1977





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BioTechnology, Inc.
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Previous reports issued during this study have included the examination of biomedical issues relating to combat escapes from aircraft, for Navy aircrewmen who were Recovered or became Prisoners of War during the Southeast Asia conflict. The data collected and analyzed from these groups proved highly beneficial in establishing injury cause and effect relationships. It was recognized however, that it did represent only that group which was successful in surviving the mishap. To completely evaluate the effectiveness of aircraft escape and survival equipment, statistics on those who were not successful

would have to be included. Consequently, this phase of the study was devoted to the collection and analyses of Navy pilots who, during combat, ejected and are classified as Missing or Killed in Action. The escape and survival data from all these casualty groups were combined into a computerized data base representing the total combat picture. From this data base, specific biomedical escape analyses were conducted and are presented in this report.

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**Final Report**

# A SUMMARY OF NAVY AIR COMBAT ESCAPE AND SURVIVAL

*by*

Martin G. Every

*Contract No. N00014-72-C-01-01*
*Task No. NR 105-667*



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## FOREWORD AND ACKNOWLEDGMENTS

This study is part of a program for the Office of Naval Research to examine the problems of combat escape and survival for Navy aircrewmen. This phase was undertaken to respond to operational requirements identified by Captain Frank H. Austin, Jr., MC, USN, and Mr. Fred Guill, Crew Systems Division, Naval Air Systems Command, Washington, D.C. Dr. Arthur B. Callahan, Program Director, Biophysics Program, Biological Sciences Division, Office of Naval Research, served as Technical Monitor for the project.

Special thanks must go to the following for their assistance in the project:

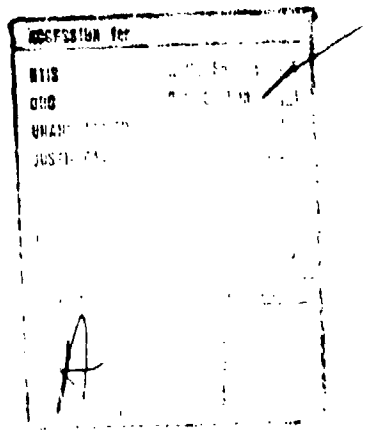
Commander J.G. Colgan, USN, Special Assistant to the Chief of Naval Personnel for Missing in Action/Prisoner of War Affairs, and his staff for providing access to the records and for their time and patience in answering our many questions during the data extraction phase.

Captain Robert E. Mitchell, MC, USN, Naval Aerospace Medical Research Laboratory, Pensacola, Florida, for his guidance on medical issues throughout the study.

The House Select Committee on Missing Persons in Southeast Asia, Under the direction of Congressman G.V. Montgomery, and its staff, for sharing with us data relevant to aircraft escape and survival.

The Naval Air System Command (Codes – 340B and 531), Office of Naval Material, Navy Bureau of Medicine and Surgery, and the Office of Naval Research for their combined support of this study.

And a very special thanks to the Navy aircrewmen whose aircraft ejection data was used in this study. It is anticipated that this information will held elucidate many of the problems experienced during combat escape, and hopefully will aid in establishing requirements for safer and more efficient life support and escape equipment in the future.



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## INTRODUCTION

The effectiveness of an aircraft escape system must be measured by its reliability and performance over the entire spectrum of escape conditions found both for combat and for noncombat missions. Comprehensive ejection injury data are routinely collected by the Naval Safety Center on all non-combat mishaps involving Navy aircraft. These data, a summary of which is published annually, have been used extensively to analyze general escape problems as well as to describe injuries from specific ejection seats. Combat ejection information, however, is not included in these data. The reason is to reduce the burden of administrative labors during critical combat periods. Consequently, Medical Officers' Reports (MOR's), such as those completed for aircraft mishaps at other times, were not required. While the reasoning for this is valid, it did result in the loss of much valuable information concerning combat escape and survival.

In October 1971, BioTechnology, Inc., under contract to the Office of Naval Research, with technical guidance provided by the Bureau of Medicine and Surgery and the Naval Air Systems Command initiated a study program to collect and analyze combat escape and survival data. The principal objectives of the program were to: (1) identify unique biomedical problems associated with the escape and survival of Navy aircrewmen under combat conditions in Southeast Asia, and (2) develop a computerized data base for use in detailed studies of specific biomedical issues, especially those relating to ejection and survival injuries, escape equipment, personal protective equipment, rescue problems, and prisoner of war survival.

This study program was accomplished in three phases. The first phase involved the collection and analysis of escape-through-rescue data from Navy aircrewmen who ejected and were successfully recovered following their air combat mishap in Southeast Asia. The next phase consisted of collecting and analyzing similar mishap and medical data from repatriated Navy prisoners of war. The third and final phase involved the collection and analysis of the limited data found to exist for those aviators classified as missing in action (MIA) or killed in action (KIA). The present report serves two purposes. First, it presents the results of the MIA/KIA study. Second, it combines the MIA/KIA data with results of the first two phases in order to review the total combat escape and rescue picture.

## PROCEDURES

A discussion of the data collection procedures and a short summary of significant findings related to each of the individual groups of interest (Recovered, POW, MIA/KIA) will be presented prior to a discussion of the total combat picture. For more detailed information relating to either the recovered or prisoner of war groups, the following technical reports, prepared earlier as part of this effort, should be consulted:

Every, M.G., & Parker, J.F., Jr. A review of problems encountered in the recovery of Navy aircrewmen under combat conditions. Prepared for the Office of Naval Research, Washington, D.C., June 1973.

Every, M.G., & Parker, J.F., Jr. Aircraft escape and survival experiences of Navy prisoners of war. Prepared for the Office of Naval Research, Washington, D.C., August 1974.

Every, M.G., & Parker, J.F., Jr. Biomedical aspects of aircraft escape and survival under combat conditions. Prepared for the Office of Naval Research, Washington, D.C., March 1976.

In order to fix the parameters for this program, the "study population" was defined as follows:

| | |
|---|---|
| Personnel: | Navy pilots and aircrewmen |
| Aircraft: | Fixed wing jet only; restricted to A-4, A-6, A-7, F-4, F-8, and RA-5C aircraft |
| Area of Loss: | Combat zone of Southeast Asia |
| Event: | Loss caused by or during enemy action |

A list of downed Navy aircrewmen whose loss fulfilled the above qualifications, was obtained from the Center for Naval Analyses. The percent falling into each casualty status from this list included:

| Casualty Group | Percent |
|---|---|
| Recovered (REC) | 40 |
| Repatriated prisoners of war (POWs) | 23 |
| Missing or killed in action (MIA/KIAs) | 37* |

*Approximately 5 percent of this group was once classified as POWs. However, they died in captivity so now are classified as killed in action.

Data collection was accomplished principally through use of an aviation combat casualty report form (see Appendix A) which covered all phases of the emergency sequence. This form was slightly modified for each of the casualty groups depending primarily on whether the individual was rescued or captured. In order to facilitate comparison with non-combat data from the Naval Safety Center, every attempt was made to keep these forms compatible with the Medical Officers' Report of Aircraft Accident, Incident or Ground Accident Form (Form 3750-7), which is the form required for all non-combat aircraft accidents and incidents. The BTI forms were pretested on a number of pilots who were not part of the study group.

Injury classifications for this study were made using the coding instructions from OPNAVINST 3750.6G, as follows:

***Major Injury*** – Any injury requiring five days or more hospitalization and/or "sick in quarters." Also any of the following, regardless of hospitalization/sick in quarters time:

1. Unconsciousness due to head trauma (transient unconsciousness due to hypoxia, hyperventilation, G forces, etc., are not to be classified as injury).
2. Fractures of any bone except *simple* fracture of nose or phalanges.
3. Traumatic dislocation of major joints/internal derangement, of the knee.
4. Moderate to severe lacerations resulting in severe hemorrhage, or extensive surgical repair.
5. Injury to any internal organ.
6. Any third degree burns. Any second degree burns involving more than five (5) percent of the body surface. Any friction burn regardless of degree that requires less than five days hospitalization or "sick in quarters" is classified as a minor injury.

***Minor Injury*** – Any injury less than major which:

1. Results in the loss of 24 hours from full performance of regularly assigned duties, but less than five days.
2. Results in loss of regular working time for civilians beyond the day or shift on which injury occurs.
3. Hospitalization for observation not to exceed 48 hours from the time of admission is not classified as an injury.

*No Injury* -- Minimal injuries which do not meet the criteria for minor injury.

In those cases where injury description and information on days of hospitalization left doubt as to the exact injury classification, the narratives, days-grounded information, or the aircrewmen's own estimate of injury severity was used to effect a categorization.

For the repatriated prisoner of war aircrewmen, additional injury information was obtained from medical records on file at the Naval Aerospace Medical Institute (NAMI), Pensacola, Florida. These medical data were available as part of the "Repatriated Prisoner of War Program". This program, under the direction of Captain Robert E. Mitchell, MC, USN, is a joint effort between NAMI and the Center for Prisoner of War Studies, San Diego, California. The program, started in 1972, is a long term study regarding the cause and prognosis of disease in former prisoners of war.

As the injury data were taken by BioTechnology personnel from NAMI files, each injury was coded in terms of the following: description, specific anatomical location, time, severity, and probable cause. The coded medical data was then transferred onto 80-column punch cards and combined with prisoner of war event data already on computer file.

The collection of missing (MIA) and killed (KIA) in action data involved the examination of various files on these aircrewmen to extract any information relevant to ejection and/or survival following the air-combat mishap in Southeast Asia. The majority of these data were collected with the help and guidance of Commander J.G. Colgan, USN, at the MIA/KIA Office, Navy Bureau of Personnel, Washington, D.C. These records included: ONI Intelligence Reports, Commanding Officer reports, SAR messages, Wingman reports, Repatriated Prisoner of War statements, North Vietnamese autopsy reports, and Joint Casualty Resolution Center reports. Additional SAR data were obtained from the Center for Naval Analyses and the Combat Data Information Center, Wright-Patterson Air Force Base, Ohio. In multiplace aircraft, where there was one survivor, data from that survivor's escape experience was used to supplement the missing aircrewman's file.

Two hundred and twenty-three MIA/KIA files were examined for evidence of escape or attempted escape following an air combat mishap. Of these, 73 contained sufficient information for coding and inclusion into the data bank. The other 150 files had virtually no information relative to attempted ejection, ejection or survival. These excluded cases are listed by aircraft type in Appendix B, along with the date of mishap and reason for deletion from the study group. These cases will be discussed later.

Information on the 73 crew members whose files were utilized range from very complete injury information (in some cases extracted from North Vietnamese autopsy reports) to relatively incomplete information, knowing only that the survivor was down and evading. In addition to the MIA/KIA information collected during this phase, complete escape and survival information was gathered on 31 repatriated prisoners of war from whom data were not collected during the earlier POW phase. These data were codified and entered into the combat data file maintained at BioTechnology, Inc., which now includes:

| Combat Data Bank | No. |
|---|---|
| Recovered Aircrewmen (REC) | 104 |
| Repatriated Prisoners of War (POW) | 137 |
| Missing and Killed in Action (MIA/KIA) | 73 |
| Total Combat Cases | 314 |

## RESULTS

This section will briefly discuss relevant data and results pertinent to individual casualty status groups (recovered, repatriated prisoners of war, and missing and killed in action). Specific findings, and supporting data, for the Recovered and the POW groups are presented in three reports cited earlier. Following the discussion of specific casualty groups, event and injury summaries will be presented as a composite of all groups, reflecting the total combat picture.

### Recovered Group

Emergency escape data were collected from Navy aircrewmen forced to eject and subsequently recovered following an air combat mishap in Southeast Asia. Included in this group were 85 pilots plus 19 BN's, RAN's, or RIO's. The mean aircraft speed at the time of initial damage was approximately 415 KIAS. In general, this damage was not so severe as to require immediate escape. Often this speed was used to gain altitude and to reach a more friendly area prior to ejection. The time from the onset of the emergency until ejection was initiated varied from two seconds to sixty minutes. Thirty-seven percent of the group, however, ejected within three minutes of the initial aircraft damage. Although many of the pilots were able to bleed off excess speed before ejecting, the ejection phase still proved to be, by far, the most hazardous in terms of injury. Major injuries during this phase were primarily due to high speed flail, seat "G" forces and through-the-canopy type of injuries. The increased incidence of flail injury over that normally found during non-combat ejection was due primarily to the large number of combat ejections at high speed. In the recovered combat group, approximately 27 percent ejected at speeds greater than 400 KIAS, whereas only five percent of the non-combat ejections occur above this speed.

If take-off and landing mishap data are omitted from operational ejection altitude curves, both combat (recovered) and non-combat data present very similar relationships. Descent and landing proved to be relatively injury free for the combat group. This is due to the following factors:

- There were fewer pre-ejection and ejection injuries in the recovered group than were found among the prisoner of war and the missing and killed in action groups. Consequently, recovered survivors were better able to prepare for landing reducing the risk of incurring new or compounding existing injuries.
- In general, the recovered group was able to eject over less populated areas and were subjected to significantly less small-arms fire than the other groups.

- Landing injuries were minimized because almost 75 percent of the recovered group came down over open water. While these water landings did produce far fewer impact injuries, shroud line and parachute entanglement produced some hazardous situations which often resulted in near fatalities.

Those individuals who came down over land faced survival problems somewhat in proportion to the degree of injury sustained. This situation was compounded by the rugged karst landscape and dense jungles of Southeast Asia. While heavy vegetation provided some measure of support in terms of hiding from the enemy, the narratives indicate that this vegetation ultimately proved more of a hindrance because of the problems it created in communicating with rescue vehicles and during the rescue itself. The subtropical climate eliminated exposure problems. There were several cases of severe thirst; however, neither hunger nor dehydration was reported as a detrimental factor by this group. Parachute entangelment in the trees created some problems because of the height of the trees in the area. In this group, one of the primary reasons for delay in ejecting was to reach open water. While the merits of this procedure have been the subject of some controversy, due to the hazards of in-water parachute entanglement, the evidence in this study does support the over water ejection in terms o time and probability of effecting rescue. Aside from the "friendly territory" aspects of over-water ejection, there were fewer injuries from the landings themselves. On the negative side, the "feet wet" at all costs attitude undoubtedly led to situations where ejection was unsuccessful due to the aircraft being out of the safe ejection envelope or disintegrating prior to the ejection attempt.

Approximately one quarter of the recovered airmen who landed in the water reported some degree of post landing parachute entanglement and six reported being pulled down by the sinking parachute. Three other cases reported entangelment with equipment other than the parachute assembly. While there are no statistics as to the number of airmen who were not successful in untangling themselves, the severity of several of the survivors' entanglement situations indicates that quick assistance was primarily responsible for their being recovered. Many entanglements were made more perilous by injuries, panic, shock, and poor physical conditioning. Some airmen reported complete physical exhaustion after a matter of seconds in the entanglement situation. In many cases, the impression was left that any further struggling to extricate themselves would have been impossible.

Over ninety percent of the recoveries reviewed were performed by helicopter during daylight hours. The data indicate that night rescues and rescues by vehicles other than helicopters were no less effective than were daylight rescues performed by helicopters. One of the primary difficulties in the recovery phase was the rescuee's lack of familiarity with the equipment used to hoist him into

the rescue craft. In some cases, airmen were not familiar with rescue equipment due to some modification which, under conditions of extreme stress, produced confusion out of proportion to a similar situation involving a non-combat rescue. In other cases, downed airmen could not properly use the rescue devices lowered to them because of injuries. In these cases, aeromedical evacuation personnel had to be lowered to assist, and recovery times were accordingly lengthened. Such operations greatly increased the vulnerability of the entire rescue team as well as that of the rescuee. Problems associated with lack of familiarity with rescue devices were indicated less frequently in later reports, as rescue devices became more standardized and airmen were better indoctrinated in their use.

### Prisoners of War

In February and March, 1973, prisoners of war held by the North Vietnamese were repatriated. Among this group were 137 Navy aircrewmen who had ejected from fixed-wing aircraft. Subsequent to their official debriefing, each of these repatriated prisoners of war was sent a copy of the Aviator's Combat Casualty Report Form (Appendix A). One hundred and six questionnaires were returned completed. Specific medical injury information from the Naval Aerospace Medical Institute was added to each of these files.

The mean speed at the time of initial aircraft damage for the recovered and prisoner of war groups was very similar. One major difference during the initial phase of the mishap, however, was the more extensive structural damage suffered by prisoner of war aircraft. The severity of this damage allowed POW aircrewmen much less time to slow and control the aircraft before initiating ejection. This frequently resulted in adverse aircraft attitude which may have produced poor body position at the time of ejection.

Altitudes at which POW's ejected were similar to those for both the recovered and non-combat groups Speed at time of ejection for POW's, however, was considerably higher than for the recovered group. Over sixty percent of the repatriated POWs ejected at speeds greater than 400 KIAS with twenty-eight percent ejecting at a speed above 500 KIAS. The fact that almost seventy-five percent of the major injuries for POW's were incurred during the ejection phase undoubtedly is a function of the high speeds. A breakdown of primary causes of these injuries include high speed flail (sixty percent), ejection seat-"G" forces (fifteen percent), and striking object in cockpit (eight percent).

There was a higher incidence of landing injuries among the prisoners of war, including fractures, severe sprains, and dislocations to the lower extremities. These injuries were attributable both to a higher percentage of POW's coming down over land and to their landing with existing injuries. The landing injury rate, however, was less than might be expected since many of the survivors came down in water-filled rice paddies.

The period of time for escape and evasion for POW's was relatively short, with almost ninety percent of them being captured within the first thirty minutes. This was due to the immediacy of escape and the large number of injuries sustained during the ejection sequence which limited the aircrewman's ability to effectively escape and evade.

For the captured survivor, any injury takes on special significance, particularly under the conditions found in Southeast Asia. Medical treatment to major wounds, if given at all, was generally substandard. Many times, wounds were used for the purpose of torture and, in all probability, many aircrewmen died from what would normally be considered a non-fatal injury. Many of these injuries were so severe that prisoners of war experienced years of agonizing pain, serious infection, and ultimately, permanent disability. Consequently, when capture and imprisonment are possible outcomes of combat operations, it is important to do whatever one can before the fact to minimize potential for injury during aircraft escape.

### Missing and Killed in Action (MIA/KIA) Group

Although the escape injury rates for the recovered and prisoner of war groups were very high, they nevertheless represented successful operation of the escape system. In order to determine the true effectiveness of these systems and procedures, it was necessary to gather data on those missing and killed in action to determine to what, if any, extent the escape system might have been involved as a cause in these losses. These losses would represent the "failure" end of the continuum describing escape and rescue system effectiveness.

Reports dealing with two hundred and twenty-three individuals classified as missing in action, killed in action, died in captivity, or presumed killed in action were examined. The one hundred and fifty cases which had little or no information concerning ejection or attempted ejection (Appendix B) did, however, possess mishap data which is relative to conditions surrounding escape and is perhaps applicable to defining the type of escape system needed under combat conditions. Some summary comments on these excluded cases include:

- In the majority of these cases, the severity of aircraft damage or time prior to impact would, in all probability, have precluded successful escape utilizing current ejection systems.

- In many of these cases, there was known to be good radio communications. In none of these cases was there any definite report of malfunction of the ejection system.
- There were fewer than ten known cases where it appeared the aircrewman had time and should have ejected. In none of these cases is there any indication that the aircrewmen attempted to eject.
- Of the thirty-five mishaps involving dual-place aircraft, in only three cases did one member eject and survive. In the other thirty-two aircraft, there is no evidence of ejection. Nor is there any information as to what happened to the other three aircrewmen who were in those aircraft with the surviving individuals.

Seventy-three MIA/KIA aircrewmen had enough data in their files to be included in the combat escape data bank. Within this group, some fifty-eight aircrewmen ejected or probably ejected and fifteen probably did not eject. The injury status of the group known to eject is given in Table 1. Many of the aircrewmen who survived ejection were killed during capture, died as a result of ejection injuries, and/or died from a subsequent lack of medical attention. By the end of the mishap (including escape and evasion) there is reasonable evidence that at least fifty-one of the group were dead. There is no information on another fifteen, and seven were probably alive when captured, later dying during some stage of captivity.

Table 1

Ejection Injury Status of Navy MIA/KIA Aircrewmen Known to Eject

| Injury Status | Number |
|---|---|
| Fatal or Probably Fatal | 9 |
| Major or Probably Major | 11 |
| Minor or Probably Minor | 13 |
| None | 2 |
| Unknown | 23 |
| TOTAL | 58 |

The known ejection speeds for the missing and killed in action group were somewhat faster than those for the prisoners of war, with approximately seventy-two percent ejecting at speeds greater than 400 KIAS. As would be expected from these high ejection speeds, the ejection injury rates were greater than for the prisoner of war group (Table 2).

Table 2

Known Ejection Injury Rate of MIA/KIA Group
Compared with POW Group

| Casualty Status | Degree of Ejection Injury | | |
|---|---|---|---|
| | Fatal or Major | Minor | None |
| MIA/KIA Group | 57% | 37% | 6% |
| Prisoner-of-War Group | 43% | 19% | 38% |

The population density and terrain at parachute landing sites for the MIA/KIA group were critical factors in determining survival following ejection. Approximately 25 percent came down over open ocean. However, for this group, this did not prove optimal for rescue. Some ejected too close to the coast and were captured by enemy boats; some were fatally wounded during descent; and some for a variety of reasons drowned prior to rescue. The inability of many of these aircrewmen to reach a more suitable ejection site was due to the catastrophic structural damage suffered by many while on target. Also, when ejection was necessary over highly populated and well defended areas, parachute descent was often through intense 37 millimeter, 57 millimeter and/or small arms fire. Landing in these areas was usually accompanied by rapid capture and mistreatment from a terrified or vengeful local populace.

It would be impossible to document all of the survival problems affecting these killed and missing aircrewmen. An excellent summary of many of these difficulties was presented by Lieutenant Commander George Thomas Coker, USN, appearing before the Board of Directors of the National League of Families of American Prisoners and Missing in Southeast Asia. Parts of this statement are so applicable to post ejection survival problems in Southeast Asia, they are included as Appendix C of this report.

Search and rescue efforts were initiated in almost all cases where there was any evidence of survival. Table 3 lists the results of the SAR efforts for these individuals. When rescues were attempted, they were often conducted under intense enemy fire. In almost half of these attempted rescues, there was either loss of or no visual or voice contact with the survivor during any of the SAR effort.

Table 3

Results of Search and Rescue (SAR)
Efforts on MIA/KIA Cases (N=73)

| SAR Outcome | Percent |
|---|---|
| Search initiated, unsuccessful | 53% |
| SAR not initiated | 23% |
| Survivor contact made, pick up unsuccessful | 15% |
| Pick up accomplished, DOA SAR vehicle | 1% |
| Unknown | 8% |

## Combined Combat Data (REC, POW, MIA/KIA)

In this section, data from the recovered, prisoner of war, and the missing and killed in action groups have been combined to present a composite picture of escape conditions and biomedical issues relating to the Navy air combat mishap. It is recognized that within this total combat group there is unequal representation for the different casualty status groups.

The ratios of aircraft type making up the combat sample used in this report are quite close to the ratio of losses found for all aircraft in Southeast Asia combat (Table 4). The largest difference in these ratios is found in the A-6 aircraft. This is due primarily to the large number of these aircraft which were downed with no information concerning the status of either aircrewman. In two place aircraft there was an almost even balance, with 70 pilots and 71 RIOs, RANs or BNs completing the questionnaire.

Table 4

Comparison of Total Navy Aircraft
Southeast Asia Losses with Ratios
Utilized in Study Group

| Aircraft | Actual Percent Making Up Navy Losses in SE Asia | Percentages Making Up BTI Study Group Sample |
|---|---|---|
| A-4 | 32 | 34 |
| A-6 | 17 | 11 |
| A-7 | 9 | 8 |
| F-4 | 23 | 25 |
| F-8 | 13 | 13 |
| RA-5C | 6 | 8 |

Table 5 shows the elapsed time from initial aircraft damage until escape was initiated. These times had a definite bearing on ejection injury rates. Forty-five percent of those aircrewmen ejecting

in the first ten seconds sustained a major ejection injury. For the group which had more than ten seconds prior to ejection, the major ejection injury rate was 29 percent.

Table 5

Time from Initial Emergency Until
Escape Was Initiated (Total Navy Combat)

| | 1-10 sec. | 11-20 sec. | 21-60 sec. | 1-10 min. | 10-30 min. | 30-60 min. | No Ans. Unknown |
|---|---|---|---|---|---|---|---|
| Number of Aircraft | 60 | 14 | 54 | 87 | 24 | 4 | 71 |
| Percent of Total | (24.7) | (5.8) | (22.2) | (35.8) | (9.9) | (1.7) | |

The very nature of combat operations dictates that most aircraft will sustain their initial damage at speeds in excess of 400 KIAS. Because of the destructive ability of present anti-aircraft weapons, this damage often disintegrates the aircraft or throws it immediately into tumbling and/or spinning. The "G" forces associated with these maneuvers may either prevent the aircrewman from ejecting or put him in such poor body position that he is highly susceptible to injury from striking objects or from adverse "G" forces during ejection.

In the two hundred and twenty three missing and killed in action cases examined, less than two percent showed evidence that there might have been some problem in initiating ejection. There were no reports of any kind of problems in the operation of the escape system. Among the recovered and prisoner of war groups, some difficulties were reported in initiating ejection and/or canopy removal. However, all of these systems eventually worked at least well enough to allow a successful escape. There were cases of survivors reporting non-ejection of the other aircraft occupant. However, in almost all of these cases it appears that the non-survivor was either incapacitated or dead while still in the aircraft.

A breakdown of all known fatal and major injuries by time of occurrence during the mishap is given in Table 6. There were 33 major injuries not included in this chart because the time of occurrence was unknown. This was especially true for survivors who suffered long-term unconsciousness during the escape. The five percent listed as having died in the crash were those individuals who sustained multiple extreme injuries and were thought to have had some chance to escape. These data include none of the cases from Appendix B.

Table 6

Time of Occurrence of Known Major Injuries
Incurred During Mishap (215 Major Injuries)*

| Pre Ejection | Ejection | Descent and Landing | Rescue | Escape and Evasion | Known During Capture |
|---|---|---|---|---|---|
| 20% | 60% | 15% | 2% | 3% | 2% |

* There were an additional 33 Major Injuries in this group the time of occurrence of which are unknown.

**Pre-Ejection**

Before discussing pre-ejection major and fatal injuries, some mention must be made concerning injuries that might have been incurred during this phase by those missing or killed in action. Because of their casualty status, most of the missing and killed in action had little or no chance to report pre-ejection injuries. However, due to the severity of aircraft damage, there is a real probability that many of these crewmen suffered in-the-cockpit injuries which proved fatal or which incapacitated them to the point where ejection was impossible. Consequently, the figures for pre-ejection injury throughout this report are, in all likelihood, considerably lower than what would be actually found in combat.

Known pre-ejection injuries made up 20 percent of the total major and fatal injuries to the downed aircrewmen. The more serious injuries were to the head and extremities. They included severe lacerations from shrapnel or aircraft explosion and severe burns from cockpit fires as a result of damage to the aircraft. These injuries also included traumatic amputation of an extremity, blindness resulting from burns, and long-term unconsciousness. The unconsciousness certainly reduced any chance of escape. Burns proved especially serious in that they hampered use of escape and survival equipment and were especially prone to infection during captivity. Many burns to the hands and arms were made more severe because aircrewmen were not wearing gloves and/or had the sleeves of the flight suit rolled up.

**Ejection**

Known combat ejection speeds are listed by aircraft type in Table 7 and by casualty status group in Table 8. In this table, significant differences are shown in the percentage of ejections over 400 KIAS among the three groups (recovered – 26.5%, prisoner of war – 60.9%, and missing and killed in action – 70.8%). These percentages are especially noteworthy when one considers that only five percent of non-combat ejections occur at over 400 knots. The combined ejection speeds are plotted and compared against non-combat speeds in Figure 1.

## Table 7

## Combat Ejection Speeds
## V/S
## Aircraft Type (Total Combat)

| Ejection Speed | A-4 | A-6 | A-7 | RA-5C | F-4 | F-8 | Total | Percent |
|---|---|---|---|---|---|---|---|---|
| 0-99 | | | | | | | 0 | |
| 100-149 | 3 | | | | 2 | | 5 | 2.1% |
| 150-199 | 9 | | 1 | | 1 | 3 | 14 | 5.8% |
| 200-249 | 15 | 2 | 1 | | 6 | 4 | 28 | 11.5% |
| 250-299 | 14 | 2 | 3 | 2 | 8 | 5 | 34 | 14.0% |
| 300-349 | 8 | 3 | 2 | | 7 | 2 | 22 | 9.1% |
| 350-399 | 8 | 5 | | 1 | 8 | 4 | 26 | 10.7% |
| 400-449 | 12 | 6 | 5 | 2 | 7 | | 32 | 13.2% |
| 450-499 | 9 | 8 | 2 | | 11 | 5 | 35 | 14.4% |
| 500 and Over | 10 | 2 | | 17 | 12 | 6 | 47 | 19.3% |
| Total | 88 | 28 | 14 | 22 | 62 | 29 | 243 | |
| Percent | (36.2) | (11.5) | (5.8) | (91.0) | (25.5) | (11.9) | | |
| Mean Ejection Speed | 318 | 394 | 339 | 548 | 371 | 354 | | |

Table 8

Known Ejection Speeds versus
Casualty Status (Non Fatal Ejections)
Casualty Status Percent

| | Recovered (102 Cases) | POW'S (116 Cases) | MIA/KIA (24 Cases) | Total Recovered POW'S MIA/KIA'S | Non-Combat |
|---|---|---|---|---|---|
| 0- 99 | 0 | 0 | 0 | 0 | 6.1 |
| 100-199 | 13.7 | 4.3 | 0 | 7.9 | 42.[illegible] |
| 200-299 | 41.2 | 14.0 | 12.5 | 25.5 | 34.5 |
| 300-399 | 18.6 | 21.6 | 16.7 | 19.8 | 11.4 |
| 400-499 | 20.6 | 32.8 | 33.3 | 27.6 | 3.9 |
| 500 and Over | 5.9 | 27.6 | 37.5 | 19.3 | 1.1 |

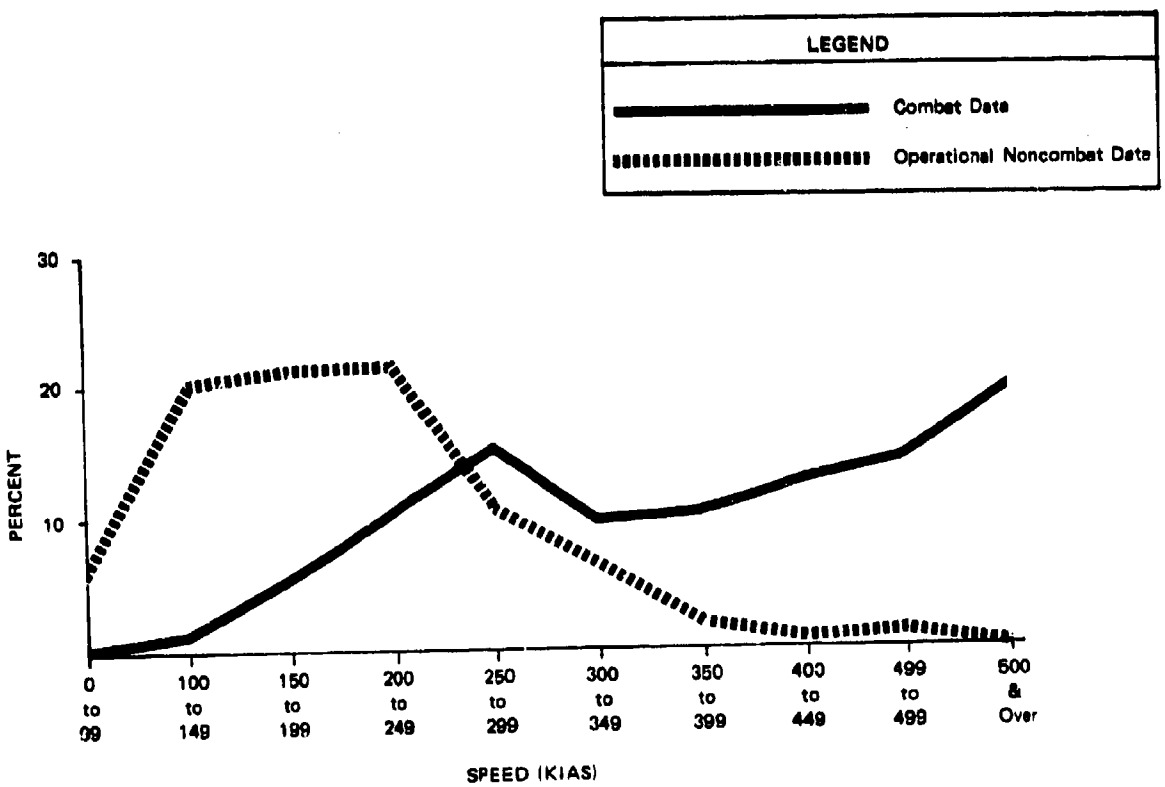


Figure 1. Combat versus non-combat ejection speeds.

The high ejection speeds encountered during combat were the primary reason for the windblast and extremity flail injuries. While windblast normally results in only minor injuries to soft tissue, flail injury is much more serious, resulting from the summation of forces over larger areas which in turn produces differential decelerations of the extremities relative to the torso and seat. Windblast injuries from high Q forces normally result only in petechial and subconjuctival hemorrhages, while flailing may cause unconsciousness, fatal brain damage, fractures, and joint dislocations to the extremities. Sixty percent of all major injuries were incurred during the ejection phase. This was due in large part to the high incidence of major flail injury. The ejection speeds and altitudes of all major fatal flail injury incidences are plotted in Figure 2. All speeds and altitudes where there was no or minor flail injury were plotted in Figure 3. The increasing frequency of major flail injury with increasing speed is readily apparent when the incidence of injury is plotted against ejection speed (Figure 4).

Extremity restraints were found to have a marked effect on lowering the incidence of flail injury. Ejection seats with leg restraints showed a considerable decrease (3.4% lower extremity flail rate) in the frequency of lower extremity flail injury as opposed to those seats with no lower extremity restraints (20 percent lower extremity injury).

There were some problems of high "G" decelerative forces which produced "reversible incapacitation." This incapacitation can be rather prolonged and highly incompatible with parachute landings in the open ocean or in flooded rice paddies.

The A-6 major injury rate during ejection was considerably higher than for other aircraft. Many of the A-6 injuries were due to striking the canopy or canopy structures. These injuries included fractures and other impact type injuries and severe lacerations from the canopy. The ejection major injury rate for those A-6 aircrewmen who ejected through the canopy was almost 50 percent, compared with no major injuries for those crewmen who jettisoned the canopy prior to escape. Table 9 lists, by aircraft type, the percentage of aircrewmen for whom there is no ejection or escape information. This table is listed here because of the high percentage found in the A-6 aircraft. Unfortunately, there is no way of telling if this lack of information is somehow related to the high injury/severity rates associated with through the canopy ejection, or is due solely to the vulnerability of an aircraft going low through heavy flack, wings loaded with "thousand-pounders."

There did not appear to be any great difference in the incidence of major flail injury with the various methods of ejection seat initiation, e.g., seat pan handle vs. face curtain. This, in all probability, is due to the Q forces which, in these high speed ejections, may impair one's ability to maintain a grip on either device. There are, however, indications, in most part taken from the indepth POW medical studies, that the incidence of major spinal compression injury is substantially higher among personnel who utilized the seat pan handle to initiate ejection.

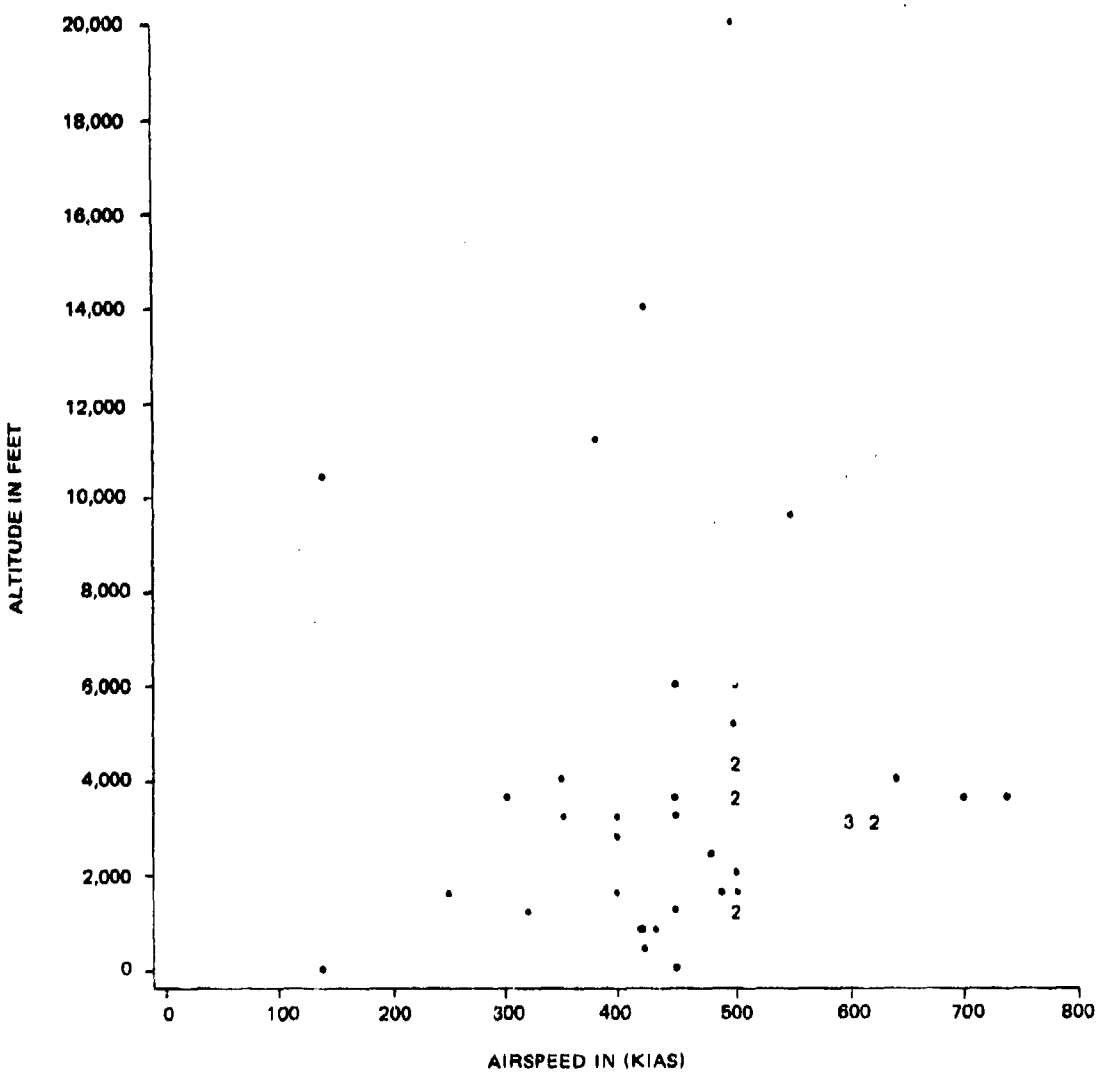


Figure 2. Ejection Speeds and Altitudes of Aircrewmen sustaining a major or fatal flail injury during ejection.*

*Number indicates the number of ejections at that point if more than one.

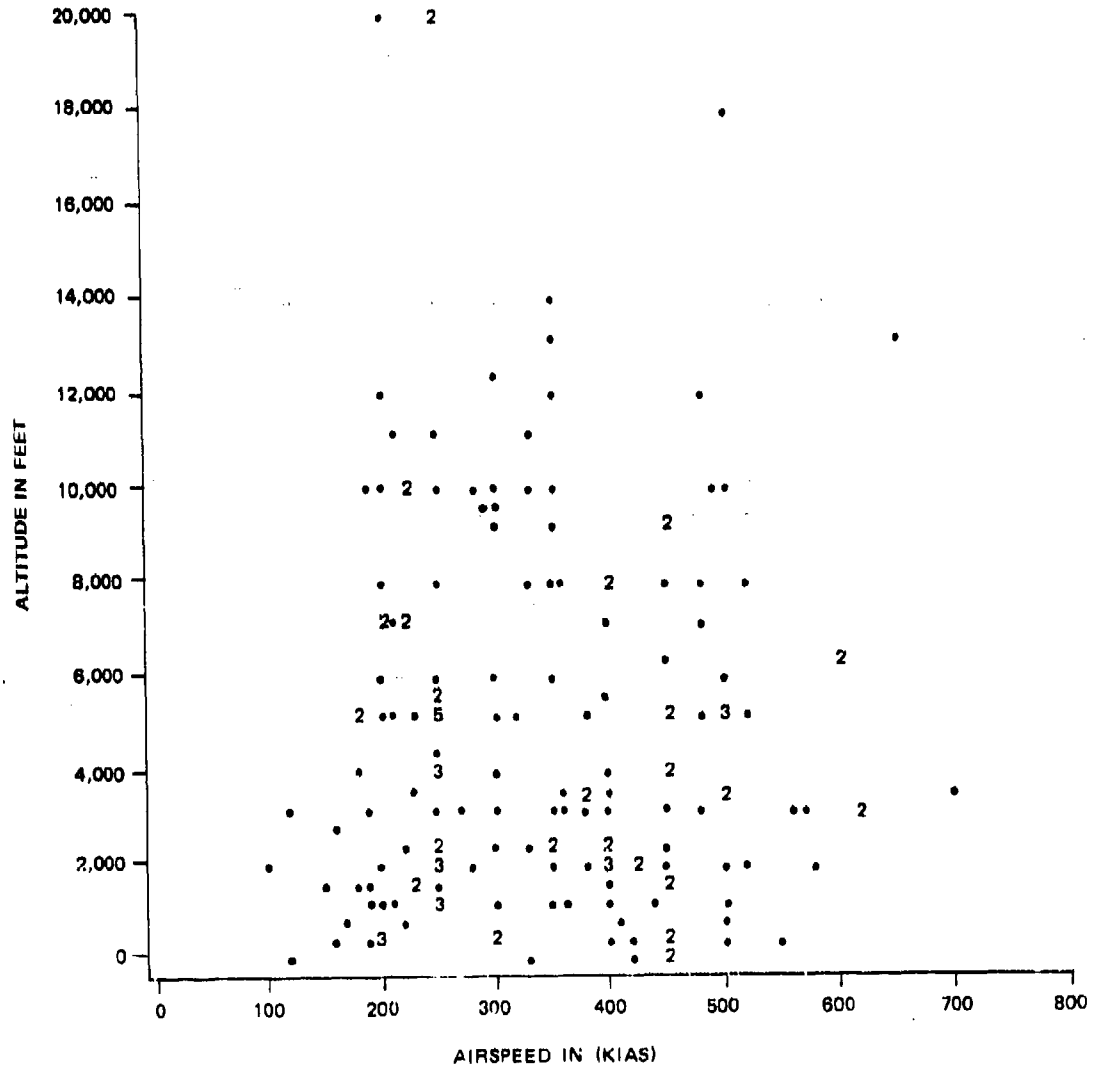


Figure 3. Ejection Speeds and Altitudes
for aircrewmen sustaining no or minor flail injuries during ejection.*

*Number indicates the number of ejections at that point if more than one.

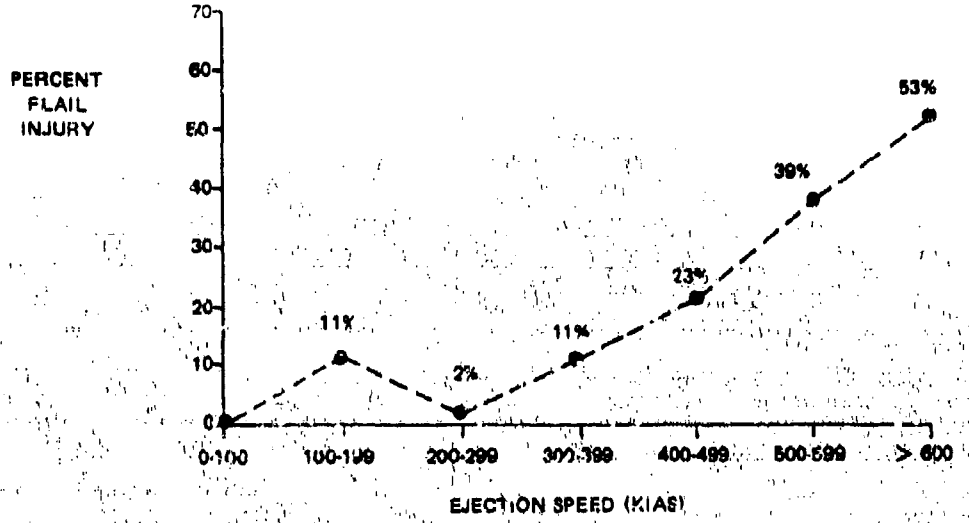


Figure 4 Incidence of major flail injury v/s ejection speed. (Total combat)

Table 9

Navy Combat Aircrewmen for Whom There is No Ejection Information (By Aircraft Type) N=150

| A-4 | A-7 | F-8 | F-4 | A-6 | RA-5C |
|---|---|---|---|---|---|
| 32% | 37% | 23% | 24% | 56% | 22% |
| Single Place A/C | | | Multiplace A/C | | |

Over ten percent of the combat personnel sustained a major spinal compression injury during ejection. There is no discernible pattern as to the role played by seat charge or by method of seat initiation on causing these injuries. As discussed previously, however, being out of proper position during ejection definitely increases the chances of sustaining a major spinal compression injury. The aircraft attitude at time of ejection (Table 10), with its obvious effect on the body position of the pilot, attests to the importance of being in the proper ejection position in order to lessen chances of injury at the time of aircraft escape.

The most important aspects of incorrect body position during ejection are having the back away from the seat and/or having a space between the buttocks and seat at the time of ejection. Figure 5 illustrates the type of injury which can result from the seat striking the upper portion of the leg when it is raised off the seat at the moment of seat firing.

## Table 10

### Aircraft Attitude at Time of Ejection versus Degree of Ejection Injury Associated with That Escape

| Aircraft Attitude | Percent of Combat Group Ejecting at That Attitude | Percent Receiving Fatal or Major Ejection Injury When Ejecting at That Attitude |
|---|---|---|
| Straight & Level | 14% | 22% |
| Not Level * | 41% | 29% |
| Out of Control ** | 45% | 40% |

* Includes nose up or down, right or left bank

** Includes spins, inverted, rolling, tumbling, mushing and/or disintegrating

Figure 5. X-Ray of leg fracture caused by leg being slightly raised off seat pan during seat ejection.

The high incidence of spinal compression fractures due to incorrect body position was reported by Chubb, et al. 1965, in an analysis of 729 USAF ejections. Of the 133 crewmen in this group known to be in other than the correct body position, 14 percent received spinal fractures. Only 1.1 percent of the 539 who felt they were in the proper position received a fracture. In the group known to be erect but under the influence of negative "G" forces, 11.9 percent received spinal fractures. It is felt that the combat body position information at time of ejection was not detailed enough to directly correlate with these data. However, a review of those severe and multiple spinal compression fractures incurred in combat indicate the vast majority did happen when the aircrewman was out of proper ejection position during the escape.

**Descent and Landing**

This phase of the mishap was responsible for approximately 13 percent of the *known* fatal and major injuries. It is suspected, however, that the descent phase was, in all probability, responsible for many more fatalities than would be anticipated from non-combat experience. This is due primarily to the amount of anti-aircraft and small arms fire directed at aircrewmen during parachute descent. There is no way of knowing the number of aircrewmen who survived ejection only to receive a fatal wound from this fire during descent, or whose parachute was so severely damaged that the descent rate proved fatal. The many reports from survivors who did come down through intense fire and from wingmen who watched other aircrewmen going down through it, attest to its lethal intensity.

Parachute opening shock was reported as severe by 20 percent of the survivors and as being responsible for a number of major injuries including severe strains and contusions. Structural damage to parachutes during these high-speed openings was such as to possibly be responsible for some rates of descent which proved fatal. Dahnke (1976) describes high-speed parachute opening tests (200-300 KEAS) which were conducted to determine parachute system integrity and the effects of acceleration and opening shock levels with regard to human injuries. These results showed the high speed parachute openings produced a high incidence of major/catastrophic damage to the canopy. In addition to canopy damage, this report discusses a number of parachute system problems which were encountered. The windblast integrity of all systems left much to be desired. This was evidenced by risers pulling out of the pack, excessive pack motion due to windblast, failure of the pack interface attachment to the survival kit, and risers blown down over the shoulders.

From combat ejection reports obtained in the present study, the major landing injury rate for survivors sustaining missing or torn parachute panels was approximately 3½ times the rate of those who had minimal or no damage to the parachute. Five individuals reported being struck by the drogue slug.

Parachute-landing terrain had a significant influence on the ultimate casualty status of an aircrewman (Table 11). For those who came down over water, landing injuries were negligible. Some problems which may have negated immediate survival, however, include (a) being unconscious or dazed, (b) pre-existing injuries preventing actuation of flotation and signaling equipment, and (c) shroudline and parachute entanglement. It is felt that many of these difficulties were directly responsible for the loss of MIAs and KIAs who came down over water. Those individuals who came down over open ocean uninjured and able to cope with entanglement problems stood, as will be discussed later, an excellent chance of being recovered by friendly forces. Coming down over relatively unpopulated open land generally favored immediate survival but greatly increased the chances of being captured. The type of terrain often dictated the type of landing injury. Rice paddies were perhaps the best, if the crewman was conscious. The rocky karst-type terrain often led to severe fractures, sprains, and dislocations of the leg, as well as spinal compression fractures from sit-down landings. Severe lacerations and contusions were incurred during descent through trees, or from being dragged over rocky terrain following landing.

**Escape and Evasion**

The period of time between parachute landing and recovery, capture, or death represents the escape and evasion phase. Unfortunately, the ultimate success of this phase is often governed by variables outside any control of the aircrewman. The type of catastrophic damage to the aircraft which occurs under combat conditions often severely limits the time prior to escape. This time is especially precious because it can be used to find a more suitable landing terrain, increase the distance from the target area, prepare for ejection, and contact search and rescue forces. For the uninjured survivor, the heavy jungle terrain of Southeast Asia could provide ideal cover for escape and evasion. This same jungle terrain, however, often limited the location and rescue of downed aircrewmen because of the decreased performance of signaling devices in this environment.

A severely injured man ejecting into heavy jungle will probably stand little chance of rescue or even capture under the conditions found in Southeast Asia. Major injuries limit survival under any circumstances. However, for a critically wounded aircrewman to have any chance for survival, under these conditions, it was imperative that he receive immediate medical attention either through rescue by friendly forces or through immediate capture by organized militia near a medical facility. The survival rates among those captured appear to be related less to the actual severity of injuries received than to the accessibility of a medical facility. Men captured in the jungle died from infections of slight scratches while other survived with massive injuries because they received at least some medical attention. Aircrewmen who were captured with severe burns, lacerations or an injury requiring amputation of a limb stood very little chance of surviving under these conditions. Capture in a remote area some distance from Hanoi greatly decreased the chances of survival due to infection rates, treatment, and the slow transport of prisoners back to the Hanoi area.

## Table 11

### Casualty Status by Primary Terrain of Parachute Landing

| | Open Sea | Large Lake River | Shallow Water Marsh or Swamp | Hard or Soft Open Ground | Trees Woods or Jungle | Rocks Ravine | Populated Area | Unknown Other or Answer | Total |
|---|---|---|---|---|---|---|---|---|---|
| Recovered | 73 | 1 | 4 | 17 | 9 | 0 | NA | 0 | 104 |
| POW | 6 | 5 | 52 | 58 | 3 | 6 | NA | 7 | 137 |
| MIA | 1 | 0 | 3 | 1 | 4 | 0 | 5 | 4 | 18 |
| KIA | 17 | 0 | 7 | 6 | 6 | 2 | 5 | 12 | 55 |

Search and Rescue (SAR)

In the first 30 minutes almost 75 percent of those individuals ejecting over open water were rescued as opposed to five percent of those ejecting over land. During this same 30 minute period over 90 percent of the prisoners of war had become captured (Figure 6). In-water recoveries were, for the most part, accomplished with minimal difficulty. Some of the more common problems which did occur included parachute or shroud line entanglement, helicopter downwash, and unfamiliarity with recovery equipment. Very seldom were there any problems with enemy gunfire.

Search and rescue operations over land were more often than not highly hazardous operations with rescue helicopters being subject to intense gunfire during the recovery. The situation is made worse when a survivor has sustained an injury which makes him unable to assist during the recovery. Location of the downed survivor often proved to be arduous, especially under thick jungle canopy which made it a problem to isolate the survivor. Location was made even more difficult because of the extensive use of false radio messages by the enemy in an attempt to down SAR vehicles.

The heavy jungle terrain often compounded existing injuries during the recovery process. The very nature of combat recovery (quick-in, quick-out conditions) exposes the injured survivor to extraction conditions which may readily cause new injuries or compounds existing ones as he is lifted through the forest canopy.

**Escape Injuries (General)**

It has been demonstrated that combat ejections result in a large number of major injuries, the consequences of which severely affect the success of escape and evasion or rescue, and increase chances of capture. The major injury rates among the various casualty groups were: Recovered – 29 percent, Prisoner of War – 53 percent, and, if fatalities are considered as major injuries, Missing and Killed in Action – 100 percent. These figures, when combined to cover all Navy aircrewmen downed as a result of an air combat mishap in Southeast Asia, result in:

| | |
|---|---|
| Major injury resulting in fatality | 36%* |
| Major injury with survival | 24%* |
| Minor or no injury | 40% |

*Approximately twice the current major-fatal injury rate for non-combat ejections 1971 – 1975 ≈ 30%.

While the importance of minor injuries has not been stressed in this report, it should be noted that under humid jungle conditions and/or the unsanitary conditions found in captivity, the infection rate of these wounds may easily affect survival chances.

Table 12 lists the locations of major injuries by reported time of occurrence. A description of these injuries is listed in Table 13. The types and severity of these injuries are relevant in determining the kind of rescue technique which should be employed, the degree of first aid knowledge necessary for the rescue crewmen, and the type of medical support equipment which should be carried in a rescue vehicle.

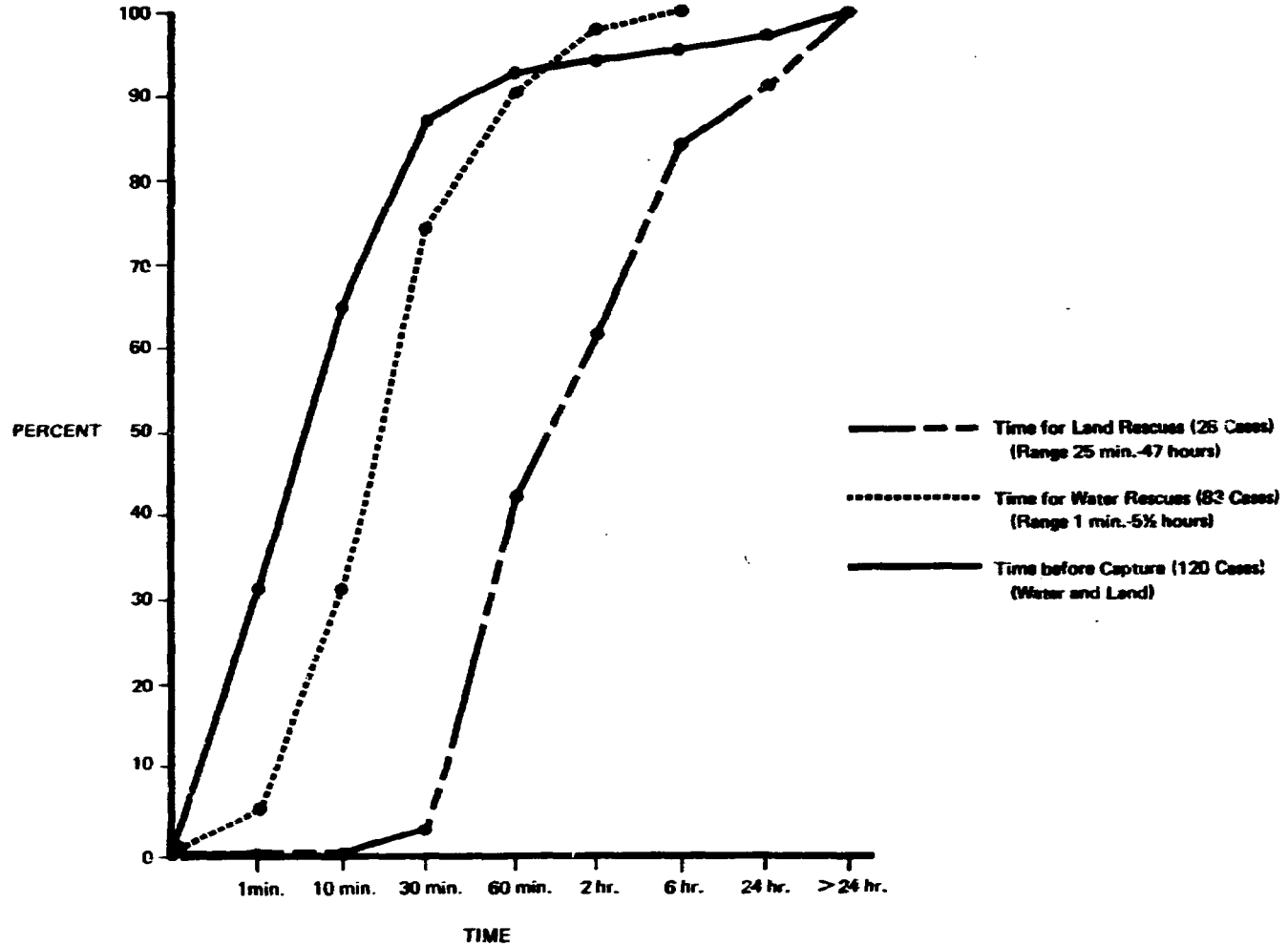


Figure 6. Cumulative percent of times to rescue and times to capture.

## Table 12

### Location of Known Navy Total Combat Group Injuries by Phase of Mishap (Major and Fatal Injuries Only)

| | Head | Upper Extremity | Spine | Torso | Lower Extremity | Neck | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Pre Ejection | 6 | 11 | 1 | 2 | 7 | 3 | 10 | 40 |
| During Ejection | 6 | 48 | 28 | 4 | 30 | 6 | 5 | 127 |
| During Descent | 3 | 0 | 2 | 1 | 7 | 0 | 2 | 15 |
| After Descent | 3 | 0 | 1 | 0 | 4 | 0 | 6 | 14 |
| During Rescue | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 4 |
| During Evasion | 3 | 0 | 0 | 0 | 1 | 0 | 3 | 7 |
| During or After Capture | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 4 |
| Unknown | 6 | 7 | 0 | 1 | 16 | 0 | 1 | 31 |
| Total | | | | | | | | |

## Table 13

### Description and Frequence of Occurrence of Known Major Injuries* Incurred During Mishap (Total Navy Combat Group)

| Injury | Number Times Reported |
|---|---|
| Fractures (Total 97) | |
| Simple | 49 |
| Spinal Compression | 28 |
| Non-Specific | 16 |
| Compound or Comminuted | 4 |
| Lacerations or open wounds | 29 |
| Dislocations | 27 |
| Burns (severe) | 15 |
| Unconsciousness (severe) | 11 |
| Torn Muscles or Ligaments | 10 |
| Sprains or Strains (severe) | 4 |
| Contusions or Hematomas | 4 |
| Infection or Disease | 4 |
| Amputation | 2 |
| Abrasion | 1 |
| Concussion | 1 |
| Hemorrhage (internal) | 1 |

*(There were 6 known losses from drowning) (multiple Extreme injuries were not included in this list.)

## SUMMARY

This report presents an overview of the biomedical issues found with Navy aircrewmen forced to make an emergency escape from fixed-wing aircraft during combat operations in Southeast Asia. The information was obtained in three phases of a larger study program, each phase dealing with one of the following casualty groups:

| Study Group | Number |
|---|---|
| *Recovered* following ejection | 104 |
| *Prisoner of war,* subsequently repatriated | 137 |
| *Missing in action, Killed in action* | 73 |
| Total Combat Cases Studied | 314 |

### Combat Escape Conditions

A major objective of the study was to review the conditions under which an emergency aircraft escape is made in combat and to compare this with non-combat escape circumstances. Along most dimensions, it was found that a combat escape is indeed "unique" and that it subjects an aircrewman to stresses considerably more severe than the average non-combat ejection. The differences of most consequence include:

| | Non Combat | Recovered Combat | Repatriated POW's | MIA/KIA |
|---|---|---|---|---|
| Mean Ejection Speed (KIAS) | 213 (1968-1972) | 302 | 407 | 453 |
| Mean time from Emergency to Ejection | Unk. | 12 min. | 1 min. | Unk. |
| Percent of in-water rescues accomplished in less than 30 minutes | 61% (1963-1967) | 43% | N.A. | N.A. |

### Injury Status

Under non-combat conditions, over 80 percent of the survivors of an emergency escape routinely are recovered either with minor injury or with no injury at all. This is not the case with a combat escape. Here the injury condition of the survivor is much worse. Further, the fact that he is injured reduces his chances of being rescued and his chances for survival if captured.

Navy aircrewmen who ejected during the Southeast Asia conflict met with the following consequences:

| Total Population Post Ejection Status | Percent |
|---|---|
| Rescued with minor or no injury | 28 |
| Rescued with major injury | 12 |
| Captured with minor or no injury (R POW's) | 11 |
| Captured with major injury | 12 |
| Missing or killed in action | 37 |
| TOTAL | 100 |

## Concluding Comments

The organization of the combat escape program, the acquisition of the data, the preparation and review of the findings, all took place over roughly a five-year period. During this time, a number of ideas and conclusions were formulated, some supported entirely by the data and others based only on what one presumes is an increasing "feel" for the situation. The following is the author's more-or-less subjective evaluation of the current Navy escape process.

The above statistics show that almost three-fourths of the combat mishaps result in "unsuccessful escapes" in the sense that the aircrewman was not returned to his unit in good condition. Yet, from the data available, and considering all the adverse conditions surrounding the mishaps – these escape systems worked as designed and remarkably well. Very few fatalities could be attributed directly to mechanical failure of an escape system, and most of the major injuries during ejection were a result of being close to, or exceeding, the airspeed limits of a safe ejection envelope.

Undoubtedly modification of present ejection systems, such as better extremity restraints, could slightly decrease ejection injury rates. Also, improved survival and life support equipment, especially in the areas of automatic parachute release, and life vest inflators, would save more lives. These measures, however, would not radically alter the type of losses described above.

To significantly improve the combat return rate will require major changes in the philosophy of escape, in current escape systems, and in search and rescue equipment and procedures. These escape systems must give the survivor the time and capability to reach an area where the chances of immediate capture will be decreased and the probability of safe location and rescue by friendly forces optimized. The new SAR systems must incorporate the latest in survivor locator equipment with dedicated SAR rescue vehicles.

The decision to incorporate costly new systems such as these will not be an easy one. However, escape in combat must be weighed against all of the economic, moral and political issues dealing with non-returned aviators, prisoners of war, and non-returned killed-in-action personnel. The safe recovery of Navy aircrewmen in future combat will require new procedures, new equipment and, most of all, new thinking. At the moment, advances in the technology of high speed escape and recovery do not match the rapid advances in aircraft design.

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# APPENDIX A

# AVIATORS COMBAT CASUALTY REPORT FORM

## 1. IDENTIFICATION & EVENT DATA

| Name | Date | Service No. |
|---|---|---|
| | | |

| Present Address | Telephone No.<br>AC |
|---|---|
| | |

| Date of Mishap | Model A/C | No. of Occupants |
|---|---|---|
| | | |

Personnel Data (On date of mishap)

| Age | Height | Weight | Rank |
|---|---|---|---|
| | _____ inches | _____ pounds | |

Missions Flown

24 Hours Prior to Mishap — Number _____ Number Hours _____

48 Hours Prior to Mishap — Number _____ Number Hours _____

Hours Slept

24 Hours Prior to Mishap

48 Hours Prior to Mishap

Flight Data (At time of initial aircraft damage)

| Terrain Clearance | Cabin Altitude | Height above Sea Level | Speed |
|---|---|---|---|
| _____ feet | _____ feet | _____ feet | |

| Aircraft Attitude | Time of day (loc.) | Cloud Conditions |
|---|---|---|
| | | |

## 2. INJURY DATA

Injuries Occurring During Mishap

| Location | Description | Time* (Sec Code) |
|---|---|---|
| Head | | |
| Upper Extremities | | |
| Spine | | |
| Torso | | |
| Lower Extremities | | |
| Other | | |

*Code for Time of Injury:
P = Pre-ejection
E = During Ejection
D = During Parachute Descent
A = After Descent
R = During Capture

Degree of Injury† at Time of Capture

☐ Major ☐ Minor ☐ None

†See attached sheet for description (Please use best estimate).

Enclosure (1)

NARRATIVE: Please give running account of the episode, including events leading to the incident (mission factors, unless classified), aircraft damage, events prior to ejection, ejection factors, descent, and survival. (Use back of page as required)

## 3. EJECTION & DESCENT DATA

### Ejection Data

Location in Aircraft (for multiple seat)

Method of Escape: Ejected ☐ Bailed out ☐ Crash landed ☐

**EXIT USED**

- ☐ 1. Normal Exit
- ☐ 2. Ejected Through Canopy
- ☐ 3. Emergency Exit
- ☐ 4. Other
- ☐ 5. Unknown

**ORDER OF ESCAPE (1st, 2nd, etc.)** _____

Narrative on Reasons, and Sequence for Ejection

**COMMUNICATIONS PRIOR TO ESCAPE**

- ☐ 1. DISTRESS SIGNAL TRANSMITTED
- ☐ 2. POSITION FIX TRANSMITTED
- ☐ 3. EMERGENCY IFF (MANUAL)
- ☐ 4. EMERGENCY IFF (AUTOMATIC)
- ☐ 9. UNKNOWN
- ☐ 0. NONE

**NUMBER OF PREVIOUS:**

EJECTIONS _____ EMERGENCY BAILOUTS _____

OTHER PARACHUTE JUMPS (TRAINING, SKYDIVING, ETC.) _____

**TERRAIN OF PARACHUTE LANDING OR CRASH SITE**

*(More than one may be applicable)*

- ☐ A - OPEN SEA
- ☐ B - LARGE LAKE
- ☐ C - RIVER
- ☐ D - DEEP WATER, OTHER
- ☐ E - SHALLOW WATER
- ☐ F - DEEP SNOW
- ☐ G - THICK ICE
- ☐ H - MARSH/SWAMP/MUD
- ☐ U - HARD GROUND
- ☐ J - SOFT GROUND
- ☐ K - BUILDING
- ☐ L - FLIGHT DECK
- ☐ M - DENSE WOODS
- ☐ N - IN TREES
- ☐ T - THROUGH TREES
- ☐ P - RAVINE/STEEP SLOPE
- ☐ Q - ROCKS
- ☐ R - IN/NEAR FIREBALL
- ☐ S - DESERT
- ☐ Y - UNKNOWN
- ☐ Z - OTHER _____

**AIRCRAFT ATTITUDE AT TIME OF ESCAPE**

*(Either in flight or after crash, ditching, etc.)*

- ☐ NOSE UP
- ☐ NOSE DOWN _____ DEGREES
- ☐ RIGHT BANK
- ☐ LEFT BANK _____ DEGREES
- ☐ A. NOSE DOWN SPIN
- ☐ F. DISINTEGRATION
- ☐ B. FLAT SPIN
- ☐ G. INVERTED
- ☐ C. OSCILLATING SPIN
- ☐ H. MUSHING
- ☐ D. ROLLING
- ☐ Z. UNKNOWN
- ☐ E. TUMBLING
- ☐ Y. OTHER (DESCRIBE) _____

**EJECTION SEAT/PARACHUTE TRAINING**

*(Not required for passengers who had no opportunity to escape)*

| TYPE OF TRAINING | TOTAL HOURS IN TRAINING | DATE OF LAST TRAINING | ROLE* |
|---|---|---|---|
| LECTURES/DEMONSTRATIONS | | | |
| TRAINING FILMS | | | |
| UNARMED EJECTION SEAT | | | |
| ARMED SEAT ON TOWER | NO. | | |
| JUMP SCHOOL | | | |
| PARASAIL TRAINING | | | |
| OTHER (SPECIFY) | | | |

*Use codes below to indicate role training played in this mishap.

0 - NO IMPORTANCE
1 - TRAINING DEFINITE HELP
2 - TRAINING POSSIBLE HELP
3 - LACK OF TRAINING FACTOR
4 - LACK OF TRAINING POSSIBLE FACTOR
9 - TRAINING ROLE UNKNOWN

## EGRESS DIFFICULTIES

| | Did You Experience Any Difficulties Due To: | Yes | Description (When? – Where?) |
|---|---|---|---|
| 1. | Buffeting | | |
| 2. | G Forces | | |
| 3. | Windblast | | |
| 4. | Seat Pins Not Removed | | |
| 5. | Difficulty Locating Canopy Jettison Mechanism | | |
| 6. | Hampered By Clothing | | |
| 7. | Hampered By Equipment (Include Body Armor) | | |
| 8. | Hampered By Injuries | | |
| 9. | Difficulty Releasing Canopy/Hatch | | |
| 10. | Failure To Release Canopy/Hatch | | |
| 11. | Difficulty Locating/Reaching Normal Ejection Mechanism | | |
| 12. | Difficulty Locating/Reaching Alternate Ejection Mechanism | | |
| 13. | Face Curtain Failed To Activate Seat | | |
| 14. | Face Curtain Problem (Locating, Reaching, Etc.) | | |
| 15. | Seat Pan Firing Handle Failed To Activate Seat | | |
| 16. | Seat Pan Firing Handle Problem (Locating, Etc.) | | |
| 17. | Canopy Jettison Problem | | |
| 18. | Canopy Jettison Failure (Automatic Means) | | |
| 19. | Could Not Open Canopy/Hatch | | |
| 20. | Difficulty Releasing Restraints | | |
| 21. | Difficulty Reaching Hatch/Exit—Obstructions | | |
| 22. | Difficulty Reaching Hatch/Exit—Injuries | | |
| 23. | Difficulty Reaching Hatch/Exit—A/C Attitude | | |
| 24. | Difficulty Reaching Hatch/Exit—Equipment Hangup | | |
| 25. | Pinned Down In A/C (Other Than Equipment Hangup) | | |
| 26. | Confusion/Panic/Disorientation | | |
| 27. | Darkness—No Visual Reference | | |
| 28. | Fire/Smoke/Fuel | | |
| 29. | Anthropometric Problem (Size/Build) | | |
| 30. | Personal Equipment Factor (Other Than Hangup) | | |
| 31. | Upper Extremities Hit Cockpit Structures | | |
| 32. | Lower Extremities Hit Cockpit Structures | | |
| 33. | Man Struck Canopy/Canopy Bow | | |
| 34. | Struck External Surface of Aircraft | | |
| 35. | Flailing – Upper Extremities | | |
| 36. | Flailing – Lower Extremities | | |
| 37. | Drogue Slug Swinging At Man | | |
| 38. | Drogue Slug Struck Man | | |
| 39. | Man Struck By Other Equipment | | |
| 40. | Man Struck By Seat | | |
| 41. | Seat Separation Difficulty | | |
| 42. | Seat/Parachute Entanglement | | |
| 43. | Man Tangled In Chute Risers – Major | | |
| 44. | Man Tangled In Chute Risers – Minor | | |
| 45. | Parachute Line Over | | |
| 46. | Man Held On To Seat | | |
| 47. | Tumbling/Spinning | | |
| 48. | Parachute Did Not Open | | |
| 49. | Parachute Streamed | | |
| 50. | Inadvertent Opening Of Lap Belt | | |
| 51. | Failure Of Lap Belt To Open | | |
| 52. | Inrushing Water | | |
| 53. | Cold | | |
| 54. | Unconscious/Dazed | | |
| 55. | Other | | |

*(Complete for all inflight escapes and ejections)*

**TIME FROM EMERGENCY UNTIL ESCAPE ATTEMPT WAS INITIATED**

HOURS _____ MINUTES _____ SECONDS _____

**DELAY IN INITIATING ESCAPE DUE TO:**

- ☐ 1. ATTEMPTING TO OVERCOME PROBLEM
- ☐ 2. REACH FRIENDLY AREA
- ☐ 3. AVOIDING UNSUITABLE TERRAIN
- ☐ 4. GAINING ALTITUDE
- ☐ 5. LOSING ALTITUDE
- ☐ 6. LOSING AIRSPEED
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

**TERRAIN CLEARANCE AT TIME OF:**

A. 1. ESCAPE (FEET) _____ 2. PARACHUTE OPENING (FEET) _____

B. 1. AIRSPEED AT TIME OF ESCAPE _____ KIAS

2. GROUND/FORWARD SPEED (IF NOT AIRBORNE) _____ K

**PROTECTIVE HELMET:**

| | CHIN STRAP FASTENED | | | HELMET VISOR LOWERED | | |
|---|---|---|---|---|---|---|
| | YES | NO | UNK | YES | NO | UNK |
| 1. BEFORE EMERGENCY | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2. DURING EGRESS | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3. DURING CHUTE LANDING | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

4. CHIN STRAP FASTENED SNUGLY YES ☐ NO ☐ UNK ☐

5. NAPE STRAP FASTENED SNUGLY YES ☐ NO ☐ UNK ☐

**ZERO LANYARD:**

A. WHEN CONNECTED

- ☐ 8. AVAILABLE, NOT CONNECTED
- ☐ 1. PRIOR TO EMERGENCY
- ☐ 2. DURING EMERGE
- ☐ 3. TIME UNKNOWN
- ☐ 8. NA/NOT AVAILABLE
- ☐ 9. UNKNOWN

B. SURVIVAL FACTOR

- ☐ 0. NOT A FACTOR IN SURVIVAL
- ☐ 1. FACTOR IN SURVIVAL
- ☐ 2. NOT A FACTOR IN NON-SURVIVAL
- ☐ 3. FACTOF IN NON-SURVIVAL
- ☐ 9. UNKNOWN IF FACTOR

**AUTOMATIC LAP BELT RELEASE**

- ☐ 0. DID NOT OPEN OR RELEASE
- ☐ 1. RELEASED AUTOMATICALLY AS DESIGNED
- ☐ 2. OPENED MANUALLY
- ☐ 3. OPENED INADVERTENTLY
- ☐ 8. UNKNOWN HOW RELEASED
- ☐ 9. UNKNOWN IF RELEASED

**REMOVAL OF AIRCRAFT CANOPY**

A. INTENT

- ☐ 1. INTENTIONAL
- ☐ 2. UNINTENTIONAL, SELF-INDUCED
- ☐ 3. UNINTENTIONAL, MECHANICAL
- ☐ 9. UNKNOWN

B. INITIATED BY

- ☐ 1. THIS INDIVIDUAL
- ☐ 2. ANOTHER INDIVIDUAL
- ☐ 9. UNKNOWN

**REMOVAL OF AIRCRAFT CANOPY** *(Continued)*

C. REMOVAL

- ☐ 0. DEFINITELY NOT ATTEMPTED
- ☐ 1. ACCOMPLISHED
- ☐ 2. ATTEMPTED (UNSUCCESSFUL)
- ☐ 3. UNKNOWN IF ATTEMPTED

D. METHOD

- ☐ 1. ARM REST/LEG BRACE
- ☐ 2. FACE CURTAIN
- ☐ 3. SEAT PAN HANDLE
- ☐ 4. MANUALLY UNLOCKED
- ☐ 5. EXTERNAL FORCE
- ☐ 6. CANOPY JETTISON HANDLE
- ☐ 9. UNKNOWN
- ☐ 8. OTHER (DESCRIBE)

**EJECTION**

A. INTENT

- ☐ 1. INTENTIONAL
- ☐ 2. UNINTENTIONAL
- ☐ 9. UNKNOWN

B. INITIATED BY

- ☐ 1. THIS PERSON
- ☐ 2. ANOTHER PERSON
- ☐ 3. EXTERNAL FORCE
- ☐ 9. UNKNOWN

C. METHOD

- ☐ 1. ARM REST/LEG BRACE
- ☐ 2. FACE CURTAIN
- ☐ 3. SEAT PAN HANDLE
- ☐ 4. SEAT SEQUENCER
- ☐ 5. IMPACT
- ☐ 6. FIRE
- ☐ 7 MECHANICAL FAILURE
- ☐ 8. OTHER EXTERNAL FORCE
- ☐ 9. UNKNOWN

**BODY POSITION AT EJECTION** *(As compared to optimal)*

| | | A. HEAD | B. HIPS | C. FEET | D. ELBOWS |
|---|---|---|---|---|---|
| OPTIMAL | 1 | | | | |
| FORWARD | 2 | | | | |
| UPWARD | 3 | | | | |
| LATERAL | 4 | | | | |
| UNKNOWN | 9 | | | | |

**POSITION OF EJECTION SEAT**

- ☐ 1. FULL UP
- ☐ 2. FULL DOWN
- ☐ 3. INTERMEDIATE POSITION
- ☐ 9. UNKNOWN

**METHOD OF SEPARATING MAN FROM SEAT**

- ☐ 0 DID NOT SEPARATE
- ☐ 1. SEAT SEPARATOR
- ☐ 2. SPONTANEOUS TUMBLING
- ☐ 3. PUSHED SELF AWAY
- ☐ 4. PERSONNEL PARACHUTE
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

## DESCENT DATA

### TYPE OF SEAT SEPARATION

- ☐ 0. NONE
- ☐ 1. ROTARY
- ☐ 2. BLADDER
- ☐ 3. PARACHUTE
- ☐ 4. SNUBBING LANYARD

### METHODS OF DEPLOYING PARACHUTE

- ☐ 0. NOT DEPLOYED
- ☐ 1. AUTOMATIC TIMER
- ☐ 2. ANEROID
- ☐ 3. BALLISTIC DEVICE
- ☐ 4. ZERO LANYARD
- ☐ 5. STATIC LINE
- ☐ 6. MANUAL
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

### PARACHUTE OPENING SHOCK

- ☐ 0. NEGLIGIBLE
- ☐ 1. MODERATE
- ☐ 2. SEVERE
- ☐ 9. UNKNOWN

| OSCILLATIONS | 0-NEGLIGIBLE | 1-MODERATE | 2-SEVERE | 9-UNKNOWN |
|---|---|---|---|---|
| A. DURING DESCENT | | | | |
| B. DURING LANDING | | | | |

### PARACHUTE DAMAGE *(Give number of)*

1. SEVERED SHROUD LINES _____
2. MISSING PANELS _____
3. TORN PANELS–MAJOR _____
4. TORN PANELS–MINOR _____

### CAUSE OF PARACHUTE DAMAGE

- ☐ 1. OPENING SHOCK
- ☐ 2. FOULED ON EJECTION SEAT
- ☐ 3. FOULED ON A/C
- ☐ 4. FIRE
- ☐ 5. ON LANDING
- ☐ 6. IN TREES
- ☐ 7. DRAGGING
- ☐ 8. OTHER (DESCRIBE)
- ☐ 9. UNKNOWN

### LANDING CONDITIONS

A. TOTAL WEIGHT UNDER PARACHUTE: _____ LBS

B. SURFACE WINDS _____ KNOTS

C. DRAGGED BY CHUTE ☐ 1. YES ☐ 8. NO

D. DISTANCE DRAGGED: _____ YARDS

### PARACHUTE LANDING POSITION TECHNIQUES

A.
- ☐ 8. COULD NOT SEE
- ☐ 1. LOOKING AHEAD
- ☐ 2. LOOKING DOWN
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

B.
- ☐ 1. FELL OBLIQUELY
- ☐ 2. FELL SIDEWAYS
- ☐ 3. FELL FORWARD
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

C.
- ☐ 1. MUSCLES TENSED
- ☐ 2. MUSCLES TOO TENSE
- ☐ 3. TOO RELAXED
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

D.
- ☐ 1. PROPER POSITION
- ☐ 2. KNEES LOCKED
- ☐ 3. ARMS IN POOR POSITION
- ☐ 8. OTHER
- ☐ 9. UNKNOWN

### DEPLOYED BEFORE LANDING

| | 1 - YES | 8 - NO | 9 - UNKNOWN |
|---|---|---|---|
| A. SURVIVAL KIT | | | |
| B. LIFE RAFT | | | |
| C. LIFE VEST | | | |

### DIRECTION FACED AT CHUTE LANDING

- ☐ 1. DIRECTLY FACING
- ☐ 2. FACING AWAY
- ☐ 3. QUARTERING, FACING
- ☐ 4. QUARTERING, BACK
- ☐ 5. DIRECTLY SIDEWAYS
- ☐ 9. UNKNOWN

**SURVIVAL NARRATIVE:** Did you have any problems with any of your survival equipment? (SEEK Kit, Flotation Equipment, Signaling Equipment, Clothing, Etc.)

**Please answer starred ★ questions only if rescue was attempted prior to capture.**

Time on ground before capture _____ Hrs. _____ Min.

**CONDITIONS PREVAILING AT SURVIVAL SITE** (*If widely variable, give range*)

A. WATER TEMPERATURE _____ °F
B. AIR TEMPERATURE _____ °F
C. SURFACE WINDS _____ KNOTS
D. WAVE HEIGHT _____ FEET
E. WAVE FREQUENCY _____ PER MIN.

F. TERRAIN
☐ 1. OPEN GROUND ☐ 5. WATER ☐ 9. UNKNOWN
☐ 2. WOODS/JUNGLE ☐ 6. ICE/SNOW
☐ 3. MOUNTAINS ☐ 7. SWAMP
☐ 4. DESERT ☐ 8. OTHER

G. WEATHER
☐ 1. CLEAR ☐ 6. SLEET
☐ 2. OVERCAST ☐ 7. HAIL
☐ 3. FOG ☐ 8. OTHER
☐ 4. RAIN ☐ 9. UNKNOWN
☐ 5. SNOW

**SURVIVAL TRAINING**

| | Type Training | Last Location | Help* |
|---|---|---|---|
| A. | WATER SURVIVAL: | | |
| | 1. Maintenance Swim | | |
| | 2. Dilbert Dunker | | |
| | 3. Parachute Drag | | |
| | 4. Immersed Cockpit | | |
| | 5. Immersed Seat | | |
| B. | JUNGLE SURVIVAL | | |
| C. | ARCTIC SURVIVAL | | |
| D. | DESERT SURVIVAL | | |
| E. | MOUNTAIN SURVIVAL | | |
| F. | SURVIVAL (General) | | |
| G. | DWEST | | |

AMOUNT OF TIME SPENT:

In Water _____ Hrs. _____ Min.

In Life Raft _____ Hrs. _____ Min.

*Help Code
0 – No Help
1 – Possible Help
2 – Definite Help
3 – Unknown

**★RESCUE EQUIPMENT USED** (*Use numbers to show sequence*)

☐ A - SLING ☐ M - GRAPNEL
☐ B - SEAT ☐ N - BOARDING LADDER
☐ C - CARGO NET ☐ P - KNIFE/AXE/SAW
☐ D - ROPE ☐ Q - MAKESHIFT CARRIER/SUPPORT
☐ E - LIFE RING ☐ R - FIRST AID EQUIPMENT
☐ F - BASKET ☐ S - TREE PENETRATOR SEAT
☐ G - BOOM NET ☐ T - HELICOPTER PLATFORM
☐ H - DAVIT ☐ U - STRETCHER
☐ J - RAFT ☐ V - CABLE CUTTERS
☐ K - WEBBING CUTTERS ☐ W - HELICOPTER RESCUE BOOM
☐ L - CHICAGO GRIP ☐ X - BILLY PUGH NET _____
☐ Y - OTHER (DESCRIBE) _____

**★TYPE VEHICLE ATTEMPTING PICKUP**

DID RESCUE PERSONNEL LEAVE VEHICLE TO ASSIST IN RESCUE? ☐ 1. YES ☐ 2. NO ☐ 9. UNKNOWN
IF SO, HOW?
☐ A. PARACHUTED ☐ C. DESCENDED LINE/LADDER/NET ☐ E. NORMAL GROUND/WATER
☐ B. JUMPED WITHOUT PARACHUTE ☐ D. LOWERED BY HOIST ☐ Y. OTHER

**HOW DID YOU CONTACT RESCUE FORCES: (After ejection)**

| Equipment | Comment |
|---|---|
| | |
| | |
| | |

**RESCUE DATA (Con't.)**

**SURVIVAL PROBLEMS ENCOUNTERED**

- ☐ 01 - INADEQUATE FLOTATION GEAR
- ☐ 02 - INADEQUATE COLD WEATHER GEAR
- ☐ 03 - LACK OF SIGNALLING EQUIPMENT
- ☐ 04 - LACK OF OTHER EQUIPMENT
- ☐ 05 - ENTANGLEMENT (PARACHUTE)
- ☐ 06 - DRAGGING (PARACHUTE)
- ☐ 07 - PARACHUTE HARDWARE PROBLEM
- ☐ 08 - ENTRAPMENT IN AIRCRAFT
- ☐ 09 - PULLED DOWN BY SINKING PARACHUTE
- ☐ 10 - ENTANGLEMENT (OTHER THAN PARACHUTE)
- ☐ 11 - UNFAMILIAR WITH PROCEDURES/EQUIPMENT
- ☐ 12 - CONFUSED, DAZED, DISORIENTED
- ☐ 13 - INCAPACITATED BY INJURY
- ☐ 14 - POOR PHYSICAL CONDITION
- ☐ 15 - EXPOSURE (HEAT, COLD, SUNBURN, ETC.)
- ☐ 16 - FATIGUE
- ☐ 17 - WEATHER
- ☐ 18 - TOPOGRAPHY (SWAMPS, MOUNTAINS, DESERTS, ETC.)
- ☐ 19 - DARKNESS
- ☐ 20 - THROWN OUT OF RAFT
- ☐ 21 - HAMPERED BY HELO DOWNWASH
- ☐ 22 - PROBLEM BOARDING RESCUE VEHICLE
- ☐ 23 - THIRST
- ☐ 24 - HUNGER
- ☐ 25 - INSECTS, SNAKES, ANIMALS, ETC.
- ☐ 26 - SHARKS
- ☐ 98 - OTHER _____

**★PROBLEMS THAT COMPLICATED RESCUE OPERATIONS** (*If rescue attempt was attempted*)

- ☐ 01 - FAILURE OF RESCUE VEHICLE (MECHANICAL PROBLEMS)
- ☐ 02 - INADEQUACY/LACK OF RESCUE VEHICLE
- ☐ 03 - FAILURE OF RESCUE EQUIPMENT (HOIST, ETC.)
- ☐ 04 - INADEQUACY/LACK OF RESCUE EQUIPMENT
- ☐ 05 - INADEQUACY OF RESCUE PERSONNEL KNOWLEDGE/TRAINING
- ☐ 06 - INADEQUATE MEDICAL EQUIPMENT
- ☐ 07 - INADEQUATE MEDICAL FACILITIES
- ☐ 08 - VEHICLE OPERATOR FACTOR (POOR PROCEDURE)
- ☐ 09 - RESCUE CREWMAN ASSIST HESITANCY
- ☐ 10 - FIRE/EXPLOSION
- ☐ 11 - ENTRAPMENT IN AIRCRAFT
- ☐ 12 - PHYSICAL LIMITATIONS OF RESCUE PERSONNEL
- ☐ 13 - PHYSICAL LIMITATIONS OF PERSON BEING RESCUED
- ☐ 14 - CARELESSNESS OF RESCUE PERSONNEL
- ☐ 15 - PANIC/INAPPROPRIATE ACTIONS OF PERSON BEING RESCUED
- ☐ 16 - RESCUE VEHICLE ACCIDENT
- ☐ 17 - COMMUNICATIONS PROBLEMS
- ☐ 18 - DRAG/ENTANGLEMENT BY DEPLOYED PARACHUTE
- ☐ 19 - TOPOGRAPHY (ROUGH SEAS, MOUNTAINS, ETC.)
- ☐ 20 - INTERFERENCE FROM OTHER VEHICLES
- ☐ 21 - VICTIM PULLED AWAY BY EXTERNAL FORCES
- ☐ 22 - WEATHER
- ☐ 23 - DARKNESS
- ☐ 24 - WEIGHT/DRAG PROBLEM NOT DUE TO PARACHUTE
- ☐ 25 - HAMPERED BY PERSONNEL/SURVIVAL EQUIPMENT OF PERSON BEING RESCUED
- ☐ 26 - FLOATING DEBRIS
- ☐ 27 - PRIMARY RESCUER DELAYED AWAITING FUTILE ATTEMPTS BY OTHER RESCUERS
- ☐ 28 - HAMPERED BY HELICOPTER DOWNWASH
- ☐ 98 - OTHER _____

★NARRATIVE ON PROBLEMS WHICH COMPLICATED RESCUE ATTEMPT(S): (Cont't. on back) Personnel, Enemy, Equip. etc.)

1. Please list in order of importance, the major things that caused problems during the escape thru capture portion of this mishap.

A.

B.

C.

2. Please list in order of importance – 3 recommendations which you feel would be beneficial during the escape, survival and/or rescue phase of this type of mishap.

A.

B.

C.

# APPENDIX B

# MIA/KIA CASES NOT INCLUDED IN STUDY GROUP

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** A-4

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 45 | 11-18-65 | 1 | Direct SAM hit — fireball — no ejection observed |
| 51 | 13- 8-65 | 1 | AA hit — aircraft observed impacting ground with canopy intact |
| 63 | 13- 9-65 | 1 | Hit by small arms fire -- no ejection observed -- no survival signs at crash site |
| 77 | 19-10-65 | 1 | Never returned from armed Recon |
| 94 | 1-12-65 | 1 | Direct AA hit — fireball -- no ejection observed |
| 101 | 22-12-65 | 1 | Aircraft observed in dive with no attempt to recover — no ejection |
| 106 | 2- 1-66 | 1 | Lost in clouds -- no further contact |
| 114 | 1- 2-66 | 1 | Last seen in steep dive — nosing over into overcast |
| 123 | 1- 3-66 | 1 | Lost in poor weather |
| 128 | 20- 3-66 | 1 | Hit by AA fire — aircraft immediately disintegrated — no ejection |
| 130 | 21- 3-66 | 1 | Mid-air collision or simultaneous SAM hit — bright flash observed. Remains at crash site indicate unsuccessful ejections. |
| 171 | 27- 6-66 | 1 | Aircraft in fireball then exploded |
| 176 | 27- 6-66 | 1 | Observed fireball in last known vicinity |
| 184 | 29- 7-66 | 1 | Aircraft observed impacting ground and exploding — Pilot believed to have not ejected |
| 198 | 12- 9-66 | 1 | Aircraft impacted ground while on bombing run |
| 210 | 10-10-66 | 1 | Aircraft believed to have impacted water after dropping rockets |
| 212 | 12-10-66 | 1 | Observed an explosion during a night armed Recon-Unknown cause |
| 215 | 20-10-66 | 1 | Aircraft observed impacting ground — cause unknown |
| 220 | 18-11-66 | 1 | Last communications on bomb run-in "In clouds and coming down" |
| 224 | 2-12-66 | 1 | 2 bright flashes observed in air and subsequently on ground during night armed Rucon. Pilots never heard from after |
| 229 | 14-12-66 | 1 | Direct SAM hit — no chute observed — aircraft crashed in fireball |
| 233 | 21- 1-67 | 1 | Believed to have impacted ground during night armed Recon |
| 245 | 15- 3-67 | 1 | Impacted water — cause unknown — no ejection |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** A-4

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 251 | 27- 3-67 | 1 | Last communications "rolling in" |
| 265 | 10- 5-67 | 1 | Hit by SAM — aircraft observed in descending glide — went inverted and crashed. No ejection observed. |
| 287 | 10- 6-67 | 1 | Lost during SAM evasion |
| 293 | 30- 6-67 | 1 | Last observed in dive bombing attack — large fireball observed 1.5 miles from target |
| 295 | 2- 7-67 | 1 | Hit by AA fire — impacted ground — no ejection observed |
| 296 | 4- 7-67 | 1 | Last seen in dive bombing attack — last communications "feet wet" |
| 297 | 9- 7-67 | 1 | SAM hit — fireball — no ejection observed |
| 324 | 29- 8-67 | 1 | High speed stallspin — impacted ground — no ejection observed |
| 334 | 7-10-67 | 1 | SAM hit, reported flameout — entered steep nose dive — on fire pulled out to a glide — began to roll nose down — impacted ground — no ejection |
| 337 | 17-10-67 | 1 | Hit by unknown AA fire — Last communications "I'm going in" Aircraft observed to impact ground with no ejection |
| 338 | 18-10-67 | 1 | Hit by AA fire — fireball — no ejection observed |
| 339 | 22-10-67 | 1 | Hit by AA fire — gentle descending glide into river |
| 343 | 25-10-67 | 1 | Last seen during missile evasion |
| 348 | 2-11-67 | 1 | Flew into ground — canopy did not separate |
| 349 | 2-11-67 | 1 | Suspect crash during low altitude night attack |
| 368 | 5- 1-68 | 1 | Night strike — lost contact |
| 384 | 27- 4-68 | 1 | Roll in during night attack — explosion observed |
| 408 | 27- 7-68 | 1 | Pilots bombs observed to detonate followed by secondary explosion — night Recon |
| 409 | 1- 8-68 | 1 | Contact lost over target |
| 430 | 14- 2-69 | 1 | Aircraft observed exploding — no ejection seen |
| 435 | 22- 6-69 | 1 | Aircraft observed to impact ground during bomb run |
| 437 | 20- 7-69 | 1 | Aircraft observed to impact ground in shallow dive |
| 452 | 21-14-70 | 1 | Aircraft crashed in target area — possible AA fire |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** A-4

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 482 | 25- 5-72 | 1 | No information |
| 494 | 10- 7-72 | 1 | No information |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** A-6

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 66 | 17- 9-65 | 2 | A/C observed impacting water with subsequent fire, cause unknown |
| 100 | 21-12-65 | 2 | Last communication "taking evasive action" Never heard from again — speculate entered undercast over mountaineous terrain |
| 121 | 18- 2-66 | 2 | Low bom run — late pull out — A/C impacted ground and exploded |
| 145 | 21- 4-66 | 2 | Last heard from shortly before commencing run — explosion observed in target area — light AA fire observed in area |
| 146 | 22- 4-66 | 2 | Aircraft impacted water — cause unknown — no ejections observed — personal survival equipment recovered — no survivors |
| 250 | 24- 3-67 | 2 | Lost communication — "Bombs away" no further communications |
| 319 | 21- 8-67 | 2 | Last seen evading MIG's and entering clouds at 6000' — last communications "Farmers" |
| 349 | 2-11-67 | 2 | Low altitude attack — explosion and fireball seen in vicinity |
| 362 | 31-12-67 | 2 | Possible SAM — lost radio contact |
| 372 | 26- 1-68 | 2 | Contact lost due to low altitude night strike — communication never established |
| 377 | 28- 2-68 | 2 | Wreckage found near last known position |
| 378 | 1- 3-68 | 2 | Communications lost enroute to target |
| 379 | 6- 3-68 | 2 | No contact made after check-in port launch — Haiphong reported A-6 shootdown but gave no crew status |
| 412 | 28- 8-68 | 2 | Only observation was explosives on ground — probably SAM hit |
| 420 | 30- 9-68 | 2 | Speculate hit at 4000 feet. Explosion observed on ground |
| 423 | 13-10-68 | 2 | Lost contact during night Recon |
| 426 | 18-12-68 | 2 | AA hit — no ejections observed prior to contact with ground |
| 427 | 20-12-68 | 1 | Direct hit — BN recovered unknown if pilot ejected |
| 441 | 22-11-69 | 2 | Lost on night Recon — wingman observed an explosion in area |
| 472 | 3- 5-72 | 2 | Lost communications |
| 507 | 19- 8-72 | 2 | Lost on night low level bombing mission |
| 531 | 21-12-72 | 2 | No information |
| 535 | 9- 1-73 | 2 | Lost in clouds in intense SAM area |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** A-7

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 406 | 27- 7-68 | 1 | Crashed while on bombing run |
| 429 | 14- 2-69 | 1 | Possible AA hit — aircraft with — no ejection |
| 466 | 6- 4-72 | 1 | Direct SAM hit — A/C impacted ground — no ejection |
| 479 | 23- 5-72 | 1 | Last communication — "I have SAM hit" |
| 487 | 13- 6-72 | 1 | Night armed Recon. Airburst observed — no further contact with A/C |
| 493 | 23- 7-72 | 1 | Last seen starting dive bombing run — explosion observed on ground |
| 499 | 17- 7-72 | 1 | Last communications "taking evasive action" Fireball seen on ground |
| 501 | 23- 7-72 | 1 | Bright flash observed in nose of aircraft — A/C went into 60 degree dive and impacted water — no ejection observed |
| 512 | 7- 9-72 | 1 | Lost contact, reported "hit by lightning while passing thru 6000 ft." Pilot stated OK and gave position — no further contact |
| 521 | 27-10-72 | 1 | Night strike wingman observed 2 SAMS — subsequent fireball on ground |
| 526 | 10-11-72 | 1 | Aircraft last observed pulling off target — subsequent search found wreckage burning |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** RA-5-C

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| none | 9-12-64 | 2 | Aircraft crashed unobserved — pilot and RAN found at crash site |
| 217 | 22-10-66 | 2 | Pilot reported hit — last communication "Missiles away" lost visual contact — never heard from again |
| none | 17- 8-67 | 2 | Lost communications "MAYDAY eject Charlie" reasons unknown no ejection observed — one helmet recovered |
| 534 | 28-12-72 | 1 | Unknown if ejected — pilot became POW — 600 KIAS ejection |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** F-4

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 19 | 9- 4-65 | 2 | Lost communications — no further contact |
| 97 | 2-12-65 | 2 | Presumed crashed in hilly terrain |
| 105 | 28-12-65 | 2 | Aircraft observed flying into ridge after bomb run |
| 122 | 1- 3-66 | 2 | Disappeared in inclement weather flying at low altitude over water |
| 202 | 19- 9-66 | 2 | A/C possibly flew into ground during SAM evasion |
| 203 | 20- 9-66 | 2 | Lost on night Recon |
| 239 | 4- 2-67 | 2 | Night mission — fireball observed on ground |
| 272 | 26- 1-68 | 1 | Lost contact during low altitude night strike — A/C blew up |
| 321 | 23- 8-67 | 2 | Direct SAM hit at 10,000 feet, A/C impacted ground — no ejections |
| 352 | 17-11-67 | 2 | Entered spin and impacted ground while evading |
| 360 | 27-12-67 | 2 | Inclement weather — lost on radar scope |
| 468 | 14- 4-72 | 2 | AA hit in cockpit — pilot and crew incapacitated — crash |
| 505 | 16- 8-72 | 2 | Probable SAM hit with crew incapacitation |

## MIA/KIA Aircrewmen Deleted from Study

**Type Aircraft** F-8

| Identification Number | Date of Mishap | Number of Aircrewmen in Aircraft Deleted | Reason for Deletion |
|---|---|---|---|
| 25 | 8- 5-65 | 1 | Aircraft hit — probable AA — pilot radioed "I've been hit, have fire warning light" A/C went into shallow dive — no ejections |
| 27 | 9- 5-65 | 1 | Aircraft impacted ground during a strafing run |
| 28 | 27- 5-67 | 1 | Aircraft struck by AA fire — A/C went into uncontrolled flight and impacted ground |
| 30 | 1- 6-65 | 1 | A/C hit during low pass rolled inverted and crashed |
| 43 | 29- 7-65 | 1 | Aircraft impacted ground on strafing pass |
| 47 | 12- 8-65 | 1 | Aircraft hit — fire — wingman saw burning A/C with canopy apparently gone |
| 59 | 8- 9-65 | 1 | Failed to return from Night Recon — last reported in a thunderstorm |
| 133 | 3- 4-66 | 1 | Pilot transmitted 2 have hit and fire warning light — 20 sec. later A/C impacted side of hill |
| 151 | 29- 4-66 | 1 | Pilot flew into rock formations |
| 228 | 14-12-66 | 1 | Hit by SAM — pilot first radioed OK — later radioed loss of control — flight leader followed aircraft all the way into impact |
| 308 | 2- 7-67 | 1 | Attempted carrier landing with damaged aircraft — hit deck — crashed into water — no ejection attempt observed |
| 374 | 14- 2-68 | 1 | Aircraft struck by SAM — Emergency beacon signal detected — unknown if ejection occurred |

# APPENDIX C

## EXCERPTS FROM PRESENTATION OF LCDR GEORGE T. COKER, USN APPEARING BEFORE THE BOARD OF DIRECTORS OF THE NATIONAL LEAGUE OF FAMILIES OF AMERICAN PRISONERS AND MISSING IN SOUTHEAST ASIA

From all reports I received, if you had a good chute you obviously are going to be a POW. I think I can substantiate – and I'll try to do it right now – that if you are coming down in a parachute, just shot down, and you just got out of your aircraft – you do have a parachute – you're not dead in the parachute yet, anyway – your chances of making it to Hanoi are 50-50. That's going to be very difficult for you to accept, and I'll try to show you why I think that way, but I will stand on that percentage.

To begin with, I mentioned before they are, blazing away like all get out at you, usually with 37's – 37's are like a huge machine gun bullet that has a tracer on it. You are just hanging there, limp in the chute, and there is nothing I can do, this junk is coming up all around me, it's just a matter of one of them finding the same spot in the sky that I'm occupying at that time. If it happens, I'm dead; and if it doesn't, I'm alive. There's nothing I can do about that. I can sit up there and kick my legs all I want to. Usually I'm so scared, and so much in shock, that I just don't budge. There is nothing that we can control about that. To put a percentage on that, I could just try to grab something out of the air and say maybe 5 percent of the guys could be lost that way. It's very real because, as I said, we have seen people shot dead in the chute beyond any shadow of a doubt to the ability to report it. How many more were we, close to, and we know that they were being shot at – and POW's can tell you time and again, like several hundred examples, where they were conscious of that junk coming up around them. How many other people who never came home whom we have never head of that were shot dead in their chutes? Perfectly healthy, 100 percent strong individual in a good chute, talking on his radio, or trying to anyway, coming down, no reason not to be a POW, and does not even reach the ground alive. There's your first cut.

How many guys, again, died that way? This is immediately upon landing. I would venture to say this is where we lost most of the guys that should be POW's; strong, healthy guys in a parachute who could, we claimed, reach the ground alive, but are killed within five minutes because of the fear, and the way the North Vietnamese hunt you down. A big section are lost immediately.

Another one that leads into a lot of erroneous reports and a lot of false hopes that I would share with you if I had not been there and seen the way the North Vietnamese operate.

A guy gets down and is not immediately captured, or is not immediately surrounded. He has an opportunity to evade. This was not my personal opportunity. They were waiting for me with open arms – but a lot of guys did evade. The guys that evaded and ended up being captured have very hairy stories; and the reason is, the North Vietnamese again, they're petrified of you.

Let's say there's a small hill – this happened to Jack because he did come down on a little hill – and there was just a little tiny hole, a dugout, so to speak, and he was just sitting in there. He couldn't go anywhere because there were bullets going all over the place. the North Vietnamese come up the hill, all of them had guns, and they are just mowing the place down. If they think you are in the bush, they'll shoot all through it, and then they'll go and look. That's not necessarily because they are vicious – not that I like to the people or want to justify them, but they are simply petrified. They shoot first and ask questions later. That was the experience up there, to a man.

Jack was only grazed on the hand. He was down low, the bullets were going all around him, finally, when they saw him, the soldier realized that he had Jack, but if being afraid, he could have blown Jack's brains out. So I say, a lot depends on the cover. If you are in a very hard place to get to that has a hard access, the odds are actually that you'll be killed, because there's no way, as there was with Jack, they finally come up on you and there you are, you know, completely in the clear, hands up, no weapons, so that they'll stop. If they have to peek around the corner, I can guarantee you it's going to be first with a few bullets, and then they'll peek around the corner.

Again that's really somewhat justified. There are a few cases where the Yank has had the opportunity to fight back, and they'll be lucky not to have their brains blown out because we will do it every chance we get. So it's not completely unfounded.

The thing is, we lose a lot of guys right there – yet the report will come back, especially if he was on the radio on the ground, you know, "Well, gee, he's resisting, he's out," you know, "he's evading. He's got to be a POW then."

I would have agreed with you in 1966. Today I have to totally disagree with you. Because our experience will indicate that if you are resisting, the odds now are not that you will be a POW; the odds are that you are going to be killed.

A lot of guys did evade. A lot of guys did resist and they were picked up; whereas, if they had surrendered, they wouldn't have been picked up, quite obviously. We probably lost a lot of guys because of that, who were killed right there by the North Vietnamese. That's very unfortunate, but that's war; it's not nice. We cannot afford the philosophy of surrender. We must resist as long as we have the means to, and I'll back that philosophy to the end. However, it cost some guys their lives.

So, there, the guy should be alive, he should be a POW, today to me means he is probably dead, simply because he was, in fact, alive on the ground; because he was, in fact, on the radio; because he was in contact with us; because that meant he was resisting and the North Vietnamese had to track him down. Now the way I view it, his odds of being alive are very slim. He will not become a POW. I have a lot of stories to back that up of guys who have escaped and the way they were captured. Of course, all these cases, often they were found in some fairly open areas. The big thing was that there were no erratic moves, but they could sense – and some guys actually were shot – alive, but were shot because they made just that, an erratic move, a sudden move, a guy came up from behind, so the guy is still holding his gun, and they shoot first and ask questions later.

Now, you get on the ground and we get into a very unpleasant topic, and that's when they are downright hostile to you after they have, in fact, captured you. Five, 10, 15 minutes have gone by, you are now a bonafide POW in the hands of the North Vietnamese, somewhere in North Vietnam, but not Hanoi. They are not particularly friendly.

Normally, if you were shot down in the panhandle down there, around the southern part of North Vietnam, the militia and the people were ready to tear you apart; and, again, probably for some pretty damn good reasons. Usually the military almost saved you. Well, in my case, it was the opposite; considering the situation, I thought they treated me halfway decent. I said that's "considering the situation." They are my enemy, they are very hostile, but, you know, they weren't downright animals to me immediately. When the military got hold of me they really put me through the program – so that was kind of opposite.

You've heard of the "Hanoi Parade?" That was one example of how the people could be psyched up there, even in Hanoi. Well, you were paraded individually down in the panhandle. I had, not a parade, but a little "showing." They dragged me out into kind of a crowd, and that night it was like sitting in a pack of wolves, and they were closing down ready to, literally, tear me apart by hand. The guy was using me as a scapegoat, psyching the people up, and when they were literally ready to pounce like wolves, he yanked me out, calmed them down, started psyching them up again, and dragged me back out in the center of them. I went through that little experience three times, and every one of those three times I did not think I was going to come out of that circle alive.

That's a common story – that's as common as paper is in the United States. Nothing exceptional about that; and some a lot worse. Guys were forced to run a gauntlet "Indian style" with a hundred armed Vietnamese on the sides. Then they proceeded to beat the hell out of him as he passed. These are little games they can play with you.

I survived because that boss-man had final control, but it was close. What happens when he loses that control at the last second? What happens when that Yank doesn't make it down to the end? There are some really vicious guys at his sides who downright club him with a rifle butt and give him a fracture. He falls to the ground and they still manage to take a few more cracks at him before they can pull him out of there.

Again, I am forced to believe that for every guy that survived that, there are guys that died from it: probably on a one-to-one ratio. This bit about being put in front of a group, run a gauntlet, being paraded – out of 350 POW's that I am personally close to, I would venture to say I could give you 200 real good stories of exactly that type of situation.

So, again, the odds of staying alive, from the healthy chute, down to the ground, are being taken away very rapidly.

If you can survive all that, the odds are you'll make it to Hanoi. You've pretty well survived. You've been shot at in the chute, you've not been shot immediately on the ground, not shot if you're evading or resisting, and not perished if put before the people in some kind of parade performance, then you've got the other 50 percent that makes it.

Once you get to Hanoi, you're going to have about a 95 percent chance of making it. But it's 50 – 50 from the healthy chute to Hanoi.

Or maybe I should clarify that. In one respect, when I say 50 – 50, that's from a chute, period; not a healthy chute. Because part of that 50 percent fatality will have to go to injuries. I am figuring loosely – and I hope you have the idea: don't quote statistics all the time – if you're injured, you are really hurting, and hurting bad. Not because they would not necessarily give you medical attention – although that was certainly a fantastic problem – not because the wound itself was that bad – although a lot of times that was a problem. The big killer was infection. They couldn't stop it amongst themselves when they had, by their standards, very good medical attention.

It was so bad that guys would have real serious problems after the North Vietnamese tried to operate on them a few times; after that they would say, "No, thanks," because the infection got them. They might fix a bone, they might fix an arm, they might do all sorts of things, but then they end up wiping you out because your body is riddled with infection. That was a killer over there. It's a hot climate, along with zero hygiene, and it tore people up. The least little scratch could lead to death over there, and that is not an exaggeration.

You get a little scratch there on your fingertip and very likely it would become infected – this happened up there to our own people – and that finger winds up blown up to the size of a baseball – not just a baseball, a softball – and wind up in one case, completely draining every bit of tissue from about here down on a hand [indicating] before finally they gave him enough medical attention to overcome the infection. That finger wasn't chopped off, it wasn't shot at, it had nothing to do within being a POW, except that he was denied medical treatment, it was infection. This is going to explain one thing right off the bat: Why are there no amputees? There's no way in hell an amputee could live. No way. To do it would take an absolute miracle. Not because of loss of blood; not because they didn't get medical attention; they could do everything in the world for him, and nearly everything else in the world being equal, he would live, but infection is going to kill him. I would not even look for an amputee.

It's almost fantastic – some of the problems which many of us had with infection. If you are injured, you're in trouble.

To give you a very real example of this, is my own case. My leg was injured. It became infected. If I had been 1 week later getting to Hanoi, I don't think I would have lived. When they finally got me there, I had to go to the hospital for an operation – this was 3 weeks later. When they took me in there I thought they were going to cut my leg off. But they cut it open and drained all the junk out, and they gave me enough medication that I overcame it. And I consider myself one of the luckiest medical cases up there. It was a very small injury, really superficial, nothing major – but it became infected. One more week and I would have been dead.

A lot of guys, if they were shot down in the panhandle, or in any remote area -- and this is where Laos will come in, particularly -- they might not -- well, not only might not, they definitely could not make it to Hanoi that quick. At Hanoi was the first time that you had any opportunity to get halfway decent medical attention -- if they wanted to give it to you -- and they didn't always want to do that. A lot of guys spent 6 weeks getting up to the main POW system in Hanoi. If they were injured, they're not going to make it. If it's a bad injury, it becomes infected. That's why there are a lot of bone injuries. Quite a lot of the bone injuries were internal. All right, they might not heal them, particularly, or set them, but guys -- you can't see it in their clothes -- but guys have all kinds of crazy bone injuries. That they could survive because most of the time it didn't get infected. With open cuts, you know, lacerations, then there's not too much chance.